OCTOBER 2, 1961

American Machinist / Metalworking Manufacturing

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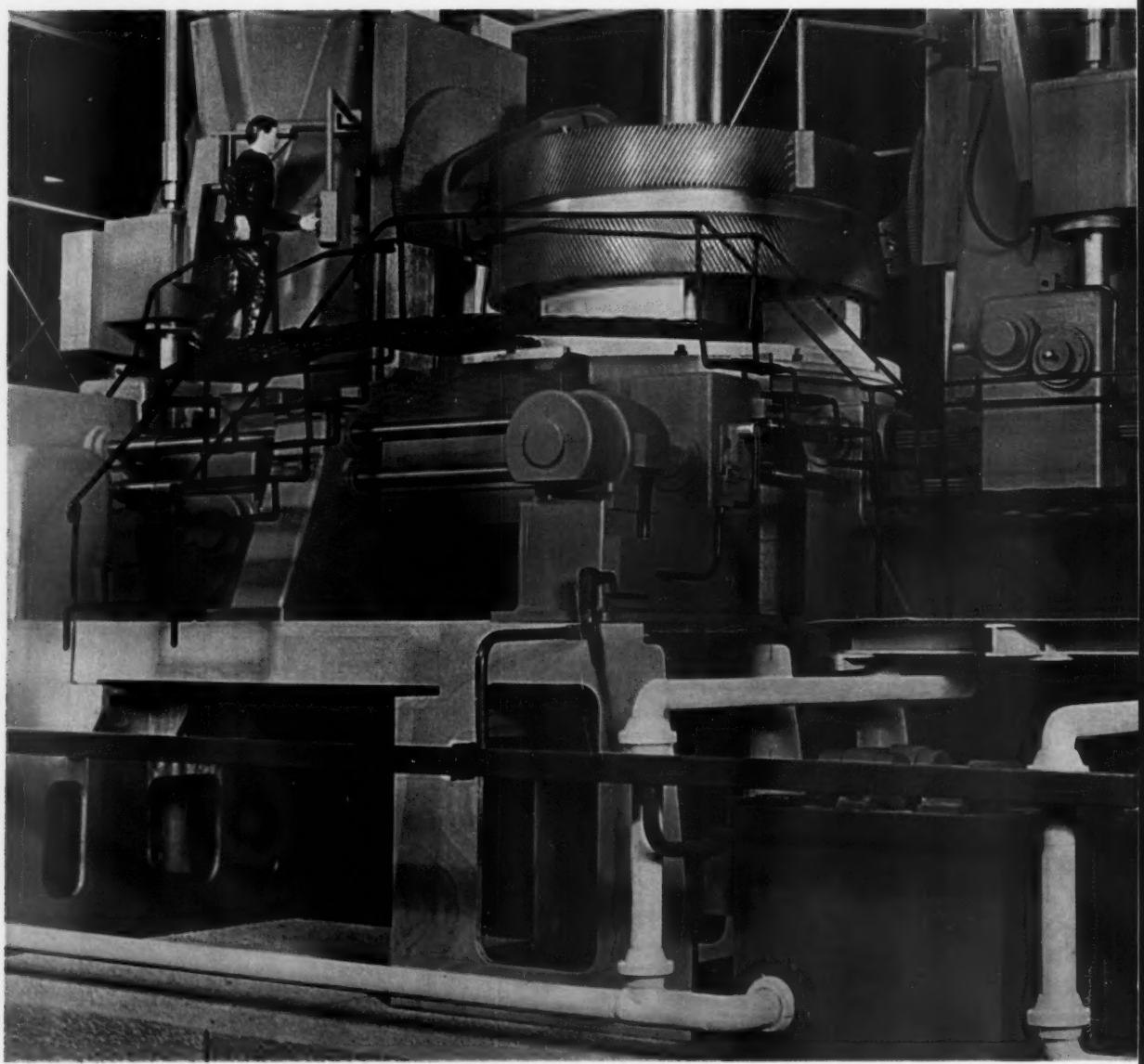


Model checks operation of hobbing machine for 200-in. diameter gears—see page 1

NEW LOOK AT TOOL ANGLES

Special Report, Page 95

A NEW TOOL-SETTING METHOD

Tool-Tronic Gage locates tool tip within .000025 by fast, simple electronic-optical method

by Alden H. Jacobson, Chief Engineer
Bore-Matic Division
The Heald Machine Company

With today's trend to greater accuracy and precision in single-point Borizing, the problem of precise tool-tip location becomes increasingly important.

Previous methods, while of high accuracy, are relatively slow and require considerable skill on the part of the operator. The optical method, using a precision-calibrated microscope, is dependent on the relative degree of operator eye fatigue. If eyestrain is a result, such an undesirable condition is known as "eyeballing." And the touch method, using dial indicators, often causes microscopic damage to the cutting edge with resulting impairment of the finished surface.

Here at Heald we have devoted a great deal of research to devise a method of tool-setting which would maintain the highest accuracy, prevent tool tip damage, and require no special operator skill.

The result is the new Tool-Tronic Gage illustrated here. Tool tip location is precisely determined by optical means, with electronic amplification giving highly accurate readings on two large meter scales.

The unit consists essentially of a sensing head which contains the light source, optics and photo cells, and a separately mounted amplifier and meter case. The sensing head is mounted vertically on the machine near the workhead, where the tool can be positioned into gage opening. As the tool is moved into place by operation of the table and cross slide, it interrupts the light rays and the amount of light passing on each side of the tool is compared to reference photocells and read out on two large horizontal-scale meters. To locate the tool with an accuracy of 25 millionths, it is only necessary to move tool in X and Y directions until the pointers on both meters are centered on the "zero" mark. For the operator to determine this precise position and return to it whenever desired requires no more skill or experience than that needed to operate the machine.

The Tool-Tronic Gage can be used with most types of single-point boring and turning machines. It should prove especially valuable on numerically-controlled contour Borizing equipment where extreme precision is required.

Tool-Tronic Gage, showing meter case, sensing head and cable.

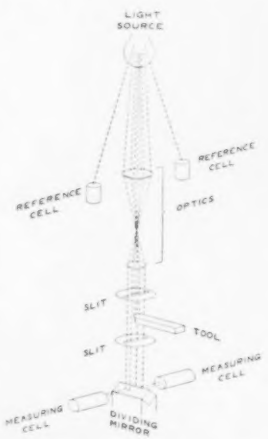


Diagram showing principle of operation of Tool-Tronic sensing head.

Tool-Tronic gage in use on a numerically-controlled Heald Model "S" Bore-Matic. Sensing head (arrow) receives tool and centering indication is read on meters at right.

Your Heald engineer will be glad to arrange a demonstration of this new tool setting gage for you, in your plant or ours.

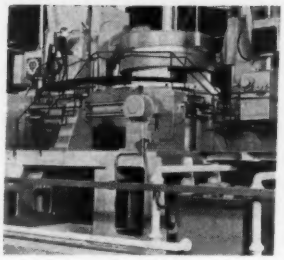
It Pays to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 251 READER SERVICE CARD

COVER:
Scale model of hobbing machine for 200-in. gears. Big hobber is being built by Michigan Tool Co for Westinghouse. See page 88.



American Machinist / *Metalworking Manufacturing*

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METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

WELDING . . . Sub-zero cold working strengthens welds in austenitic stainless steels. In an AWS paper, W P Hatch and W C Malatesta of Watertown Arsenal Labs and G M Orner of Manufacturing Laboratories, Inc, report **100% tensile joint efficiencies in full-hard Type 301 stainless sheet** that was Mig-welded with an essentially matching Type 308 electrode and then treated this way. The **softened heat-affected zone was also restored to original strength** and satisfactory ductility levels were attained.

CUTTING . . . Rene 41 (Rh 42C) can best be turned with a cutting tool that has a −4°44′ back rake and a 20°26′ side rake, according to cutting tool tests performed at Chance Vought Corp (Dallas). Tests show **there is an optimum cutting tool geometry for every tool material.** How to find these optimum angles is explained in the special report, p95.

JOINING . . . Beryllium helps make diffusion bonds between high-temperature alloys. At Westinghouse Electric Corp, the beryllium was applied in a thin layer by painting or by vacuum deposition until nickel-beryllium alloys (0.28 to 3.02% Be) were developed and rolled to thin sheets for easier preplacement of controlled amounts of beryllium. W Feduska and W L Horigan reported to the AWS Fall Meeting that the **technique has made joints with high shear strength** in a variety of high-temperature alloys.

FORMING . . . Up to 2000 cans a minute spin off a can-making machine that American Can Co (its developer) calls "the first major advance in can-making machinery in over 25 years." The machine **makes cans from a continuous ribbon of sheet metal** (aluminum, tin plate, thin tin plate, or "tinless" steel plate), by forming the ribbon into tube, welding edges together, and automatically cutting it into bodies **at over 3 times the conventional rate** for can-making machinery.

FINISHING . . . Aluminum powder can be plated on steel strip with a method developed by the British Iron and Steel Research Assn (London). While the strip is passed through a suspension of aluminum powder, high-voltage dc, which passes between strip and an anode, causes the powder to deposit on the steel. **Coated strip is then lightly rolled and resistance heated to bond the aluminum.** Elphal, name of the finished material, can be anodized for decorative purposes, **will deform severely without damaging the coating.**

INSPECTION . . . A new nondestructive tester that checks chemical specs of unknown metals and alloys works on the Seebeck effect, where a hot junction between two dissimilar metals produces a characteristic emf dependent on temperature of the junction and the composition of the metals. **A temperature of 350 F (±5 F) is maintained on the hot probe.** Argonne National Laboratory has used the instrument, which they developed, to test 2¼ Cr—1 Mo steels in a piping system, and samples were easily identified.

CUTTING . . . Parts weighing over 700 pounds are machined to 40 millionths by a series of eight programmed boring machines developed at the Sverdlov Works (Leningrad, USSR). The coordinate borers, said by Tass to be the largest of their type in the world, are **fitted with cybernetic devices that program the work and control its accuracy.** The Russian news agency also reports that the Leningrad machine-building industry, of which the Sverdlov Works is a part, is concentrating on super-precise tools, with three plants in the area making only machine tools of high precision.

FORMING . . . Hydrostatic extrusion of aluminum alloys, copper, and mild steel can be done at lower pressures and will produce more uniform structures, reports the National Engineering Laboratory (East Kilbride, Scotland). Billet head and die entry are conical. After billet is placed in a hydraulic chamber, it is **forced through die by high-pressure oil, which acts as a lubricant as well as a ram.** At extrusion ratios between 2 and 25, extrusion pressures are 30 to 40% below conventional requirements.

MANUFACTURING CONTROL . . . Up to 40 machines can be monitored with a typewriter-sized device called the Bar Chart Recorder. Telephone wires connect each machine to the recorder, which consists basically of a rotating drum, an inkless chart with 40 vertical bars, and a stylus (see cut). Here's how it works: **Every 20 seconds the device samples and records each machine,** marking a horizontal line in the appropriate vertical bar when the machine is operating. If the machine is idle, no line appears. Machine, developed by Electronic Associates, Inc (Long Branch, NJ), can also give operator, job, and shift numbers.

INSPECTION . . . Optical checking of airfoil frames is considered obsolete for the Advanced Terrier missile being built by General Dynamics/Pomona (Calif). Instead, they use a tape-controlled aerodynamic surface analyzer, which does the job automatically and better. The machine, designed by GD/P, **completely inspects the airfoil and presents operator with tabulated information about deviations that might cause the missile to veer from its ballistic path.** Details on Terrier's tooling starts on p81.

WELDING . . . Flat welds have best fatigue strength, according to M D Randall and R E Monroe of Battelle Memorial Institute and H Fall and D Brugioni of Caterpillar Tractor Co. **Flat welds can be produced by careful fitup and process control or by grinding off weld reinforcement,** both of which add to cost. Thus, it becomes a matter of economics: Added manufacturing costs or added material cost must be weighed against the greater fatigue strength they will give.

Continued on next page

Coming in AM/MM's Metal Show Issue

- *Production man's guide to leaded steels*
- *Twin lines speed heat treating*
- *Metallurgical sleuthing*

METALWORKING REPORT . . .

CUTTING . . . Chemical milling of stainless has come out of the laboratory onto the production floor. At Grumman Aircraft Corp (Bethpage, NY) researchers have solved the problems that make etching of stainless so difficult. Now Grumman **regularly chem-mills stainless to production tolerances of ±0.005 in.** Full details on this development will be reported in a forthcoming issue.

WELDING . . . Electromagnetic stirring vibrates an arc-welding puddle and improves weld deposit in tests performed at Armour Research Foundation. Tests on aluminum indicate that stirring refines grain structure and alters the normal dendritic patterns. This effect may be **quite significant when applied to alloys that are prone to hot cracking or segregation,** according to an American Welding Society paper by D C Brown, F A Crossley, J F Rudy, and H Schwartzbart.

MATERIALS HANDLING . . . Workers can load all three boxes at once on a new platform truck, even though two of the boxes are stacked. How? **The top box in the stack is attached to movable arms,** so that it can be swung out over the bottom unit (much like the swingout tray in toolboxes). A flatbed, 4-wheel chassis carries the receptacles on the truck developed by Fisher Div of National Vulcanized Fibre Co.

HEAT TREATING . . . A furnace heating element for use up to 1700 C without a protective atmosphere and in a horizontal position (because of the material's high temperature strength) has been developed by Norton Co. Made of silicon carbide-molybdenum disilicide, the Super Hot Rod is tubular, and the **hot zone is formed by a helix cut directly through the tube wall.** Helix angle determines exact length of hot zone, electrical resistance. Elements also can be used vertically, and in protective atmospheres.

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AMERICAN MACHINIST/METALWORKING MANUFACTURING, published bi-weekly by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder.

SUBSCRIPTION PRICE: Available only by paid subscription. Publisher reserves the right to refuse non-qualified subscriptions. Subscriptions are solicited only from manufacturing executives and engineers in the metalworking industries. Position, company connection, and principal product manufactured at subscriber's plant must be indicated on subscription orders forwarded to address in box below. United States subscription rate for individuals in the field of the publication $3.00 per year, single copies 75 cents. Canada $4.00 per year, foreign $25.00 per year, payable in advance.

EXECUTIVE, EDITORIAL, CIRCULATION, ADVERTISING and PUBLICITY OFFICES: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Telephone: LOngacre 4-3000. Teletype: TWX N. Y. 1-1636. Cable Address: McGRAWHILL, New York.

PRINTED IN GARDEN CITY, N. Y. Second-class postage paid at New York City and Garden City, N. Y. Title registered in U. S. Patent Office.

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SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, American Machinist/Metalworking Manufacturing, 330 W. 42nd St., New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

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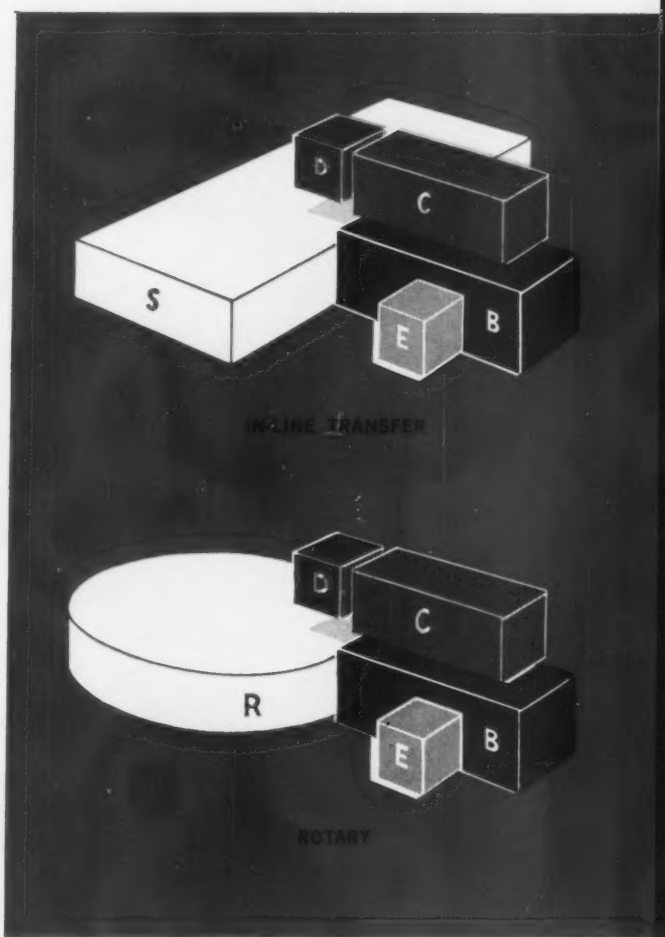
CINCINNATI | SPECIAL MACHINE DIVISION

BUILDING BLOCK CONCEPT

Cuts Automation Lead Time



ADVANTAGES OF AUTOMATION can be realized a lot sooner than you might expect. Through a building block concept for production machines and production lines, Cincinnati Milling's Special Machine Division cuts lead time to the barest minimum. Six commonly used "building blocks" are illustrated in the drawings. Notice that five of the six blocks are common to both straight line traverse and rotary table machining equipment.

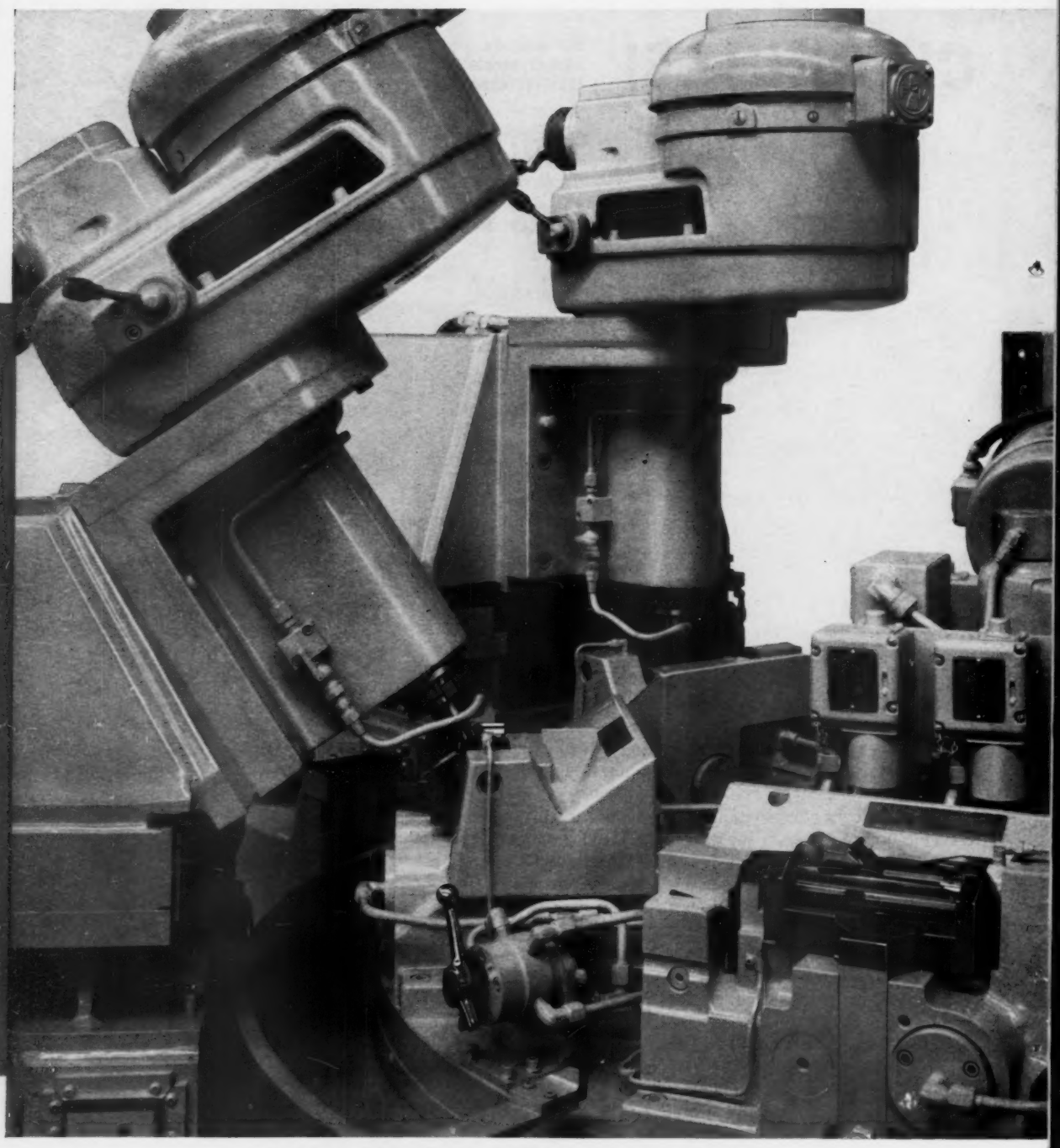
The main bed, blocks R and S, determines the major configuration of the machine: rectangular for longitudinal table traverse or in-line transfer equipment; round for rotary machines. Bolted to mounting surfaces are wing bases or columns B, and these in turn support headstocks or horizontal feed units C, and spindle heads, broach holders, etc., D. Block E represents the hydraulic unit.

Through the proper arrangement of these basic units, Cincinnati gives you special-purpose production equipment in a minimum of lead time, and with the dependability of Cincinnati Milling's integrated facilities. Examples of space-saving Rotary Index Machining Centers are shown on the two pages following. **Special Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

CINCINNATI®
SPECIAL MACHINE DIVISION

DESIGNERS AND BUILDERS OF
SPECIAL MACHINES • HORIZONTAL BROACHING MACHINES • COMPLETE PRODUCTION LINES

CINCINNATI Rotary Index Machines



Two milling heads, part of the CINCINNATI Six-Station Rotary Index Machine illustrated at right. The workpiece, a complex gun receiver, is visible in fixture.

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THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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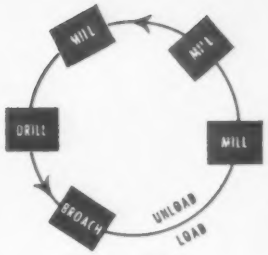
perform low-cost production line work in space-saving circular paths

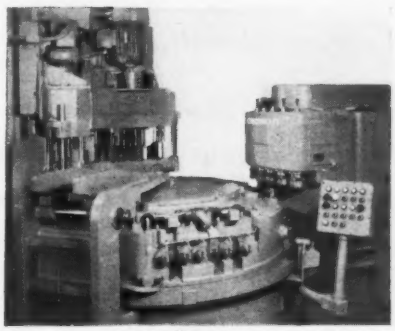


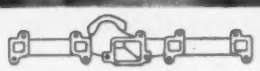
Take a straight production line, bend it into a circle, and you have the basic idea of CINCINNATI Rotary Index Machines. These unique machines perform several operations, such as milling, drilling and broaching, taking the work in a space-saving circular path.

Cincinnati Milling's Special Machine Division builds highly successful, dependable machines of this type. They are particularly suitable for low-cost production of parts that can be conveniently loaded and unloaded by hand. However, automatic loading and ejecting equipment can, in many cases, be utilized. The complete cycle is automatic: clamping and unclamping, machining and indexing from one station to the next.

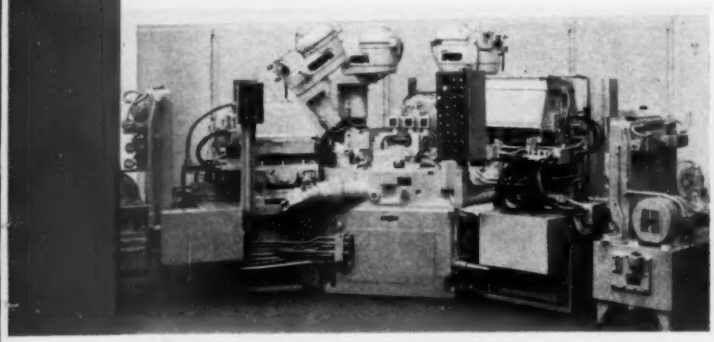
All machines of this type include standard time-tested mechanisms and units which are used in other Cincinnati-built machine tools. And all incorporate the "building block" approach to construction, offering several advantages including reduced lead time. This important consideration is briefed on the page preceding this spread.

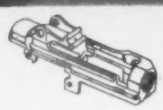
Cincinnati Special Machine Division is staffed and equipped to build all types of automatic machines and production lines having any degree of automation, including the use of CINCINNATI ACRAMATIC numerical control. May we help you to achieve lower costs and greater productivity?



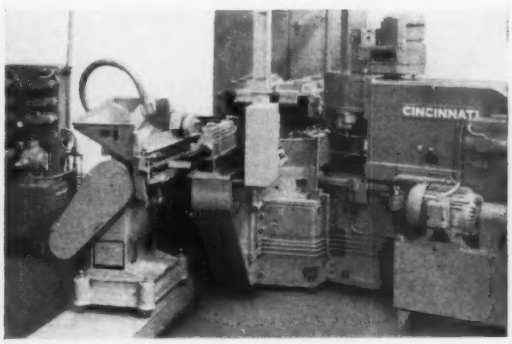


Milling, drilling and broaching operations are completed on exhaust manifolds at a production rate of 105 parts per 48 minute hour. Broaching is free, performed during the rapid index segment of the cycle.





Thirty separate milling operations on gun receiver parts are performed by six CINCINNATI Station-Type Rotary Machines, one of which is illustrated above. Production, 90 parts per 48 minute hour.



Automatic loading and unloading keep this CINCINNATI busily performing three operations on 600 cotton picker spindles per hour.

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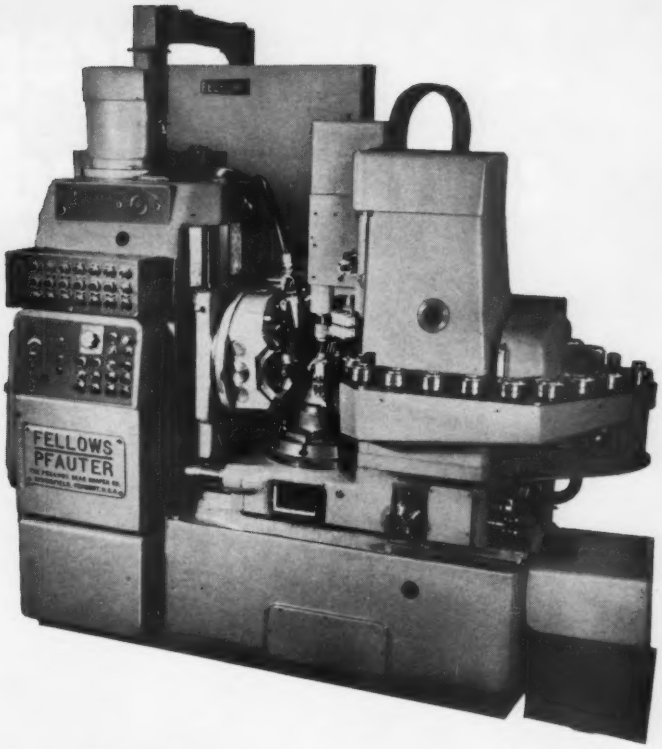
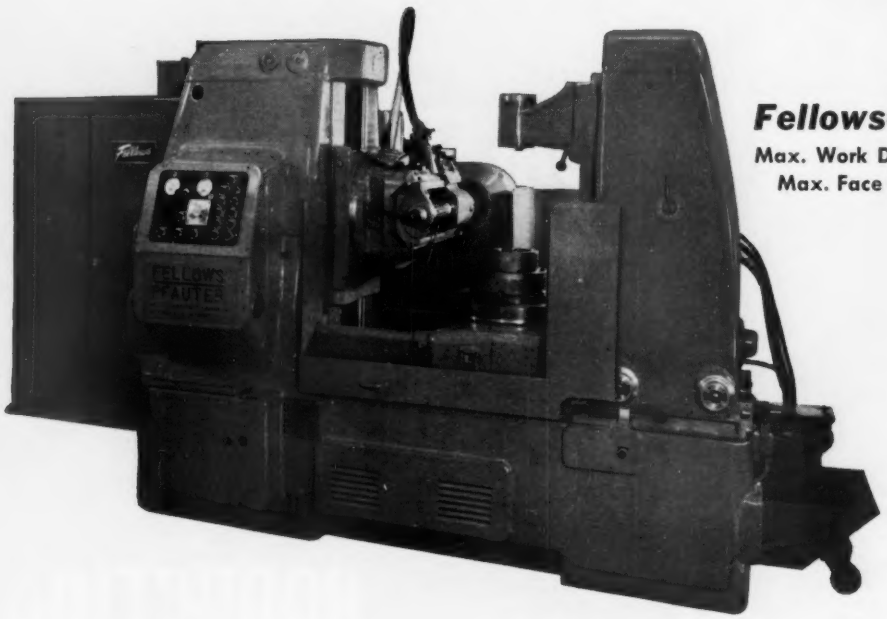


Fellows-Pfauter P400

Max. Work Dia. — 16″; Max. D.P. — 4;
Max. Face Width — 11″ at 16″ dia.;
Hob R.P.M. — 80-500.



Fellows-Pfauter P630

Max. Work Dia. — 25″; Max. D.P. — 3;
Max. Face Width — 16¼″ at 25″ dia.;
Hob R.P.M. — 62-390.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U.S.A.

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Gear Production Equipment

A new concept for cutting grinding costs

RELIABLE

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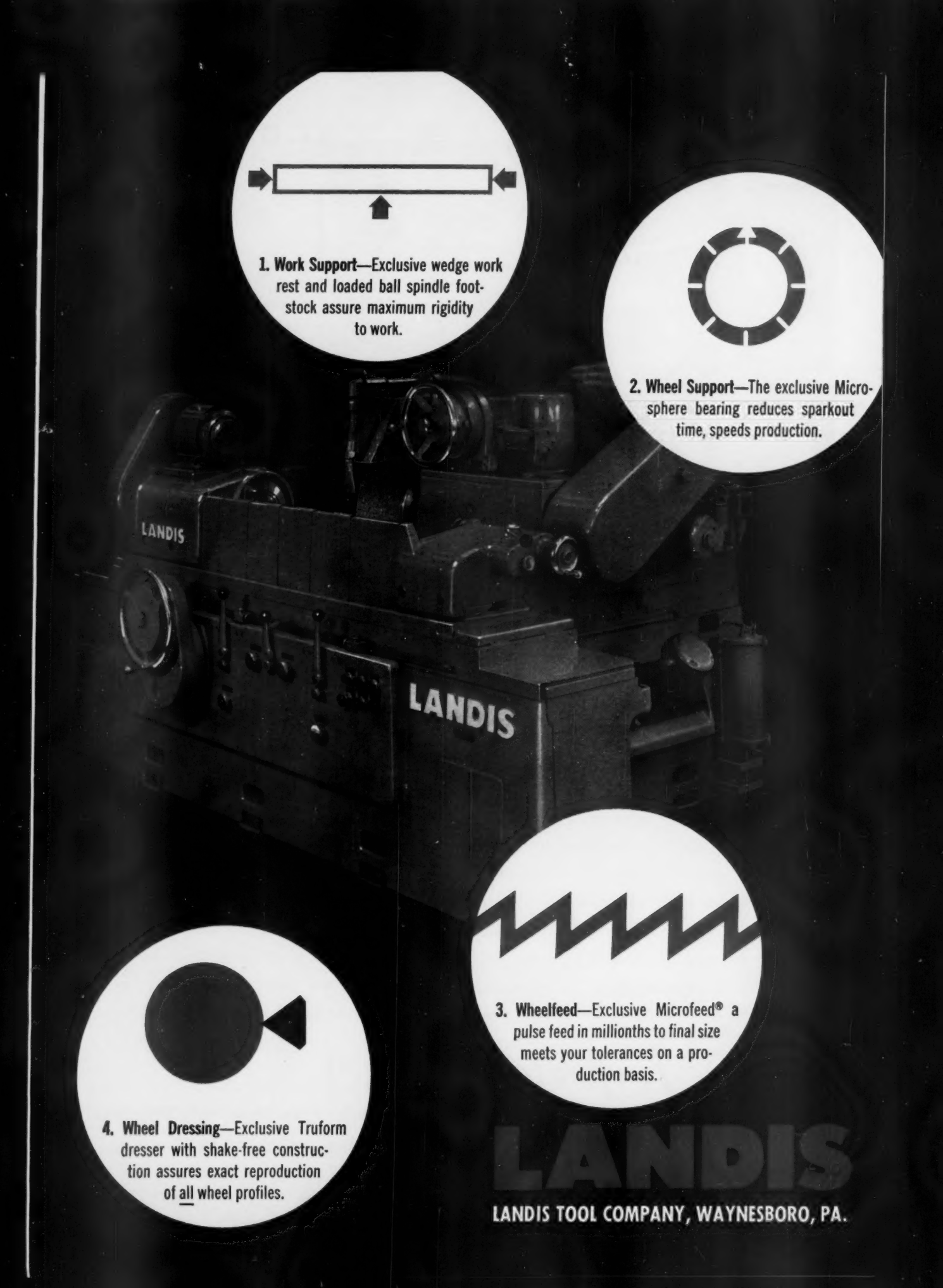
PRODUCTION

Exclusive Landis features that assure reliable —

1. Work Support
2. Wheel Support
3. Wheelfeed
4. Wheel Dressing

To meet today's requirements for tolerances in millionths, consistently on mass produced parts, the new Landis plain cylindrical grinders were designed with features to improve all the factors that affect grinding output. This assures you reliable quality production.



1. Work Support—Exclusive wedge work rest and loaded ball spindle footstock assure maximum rigidity to work.

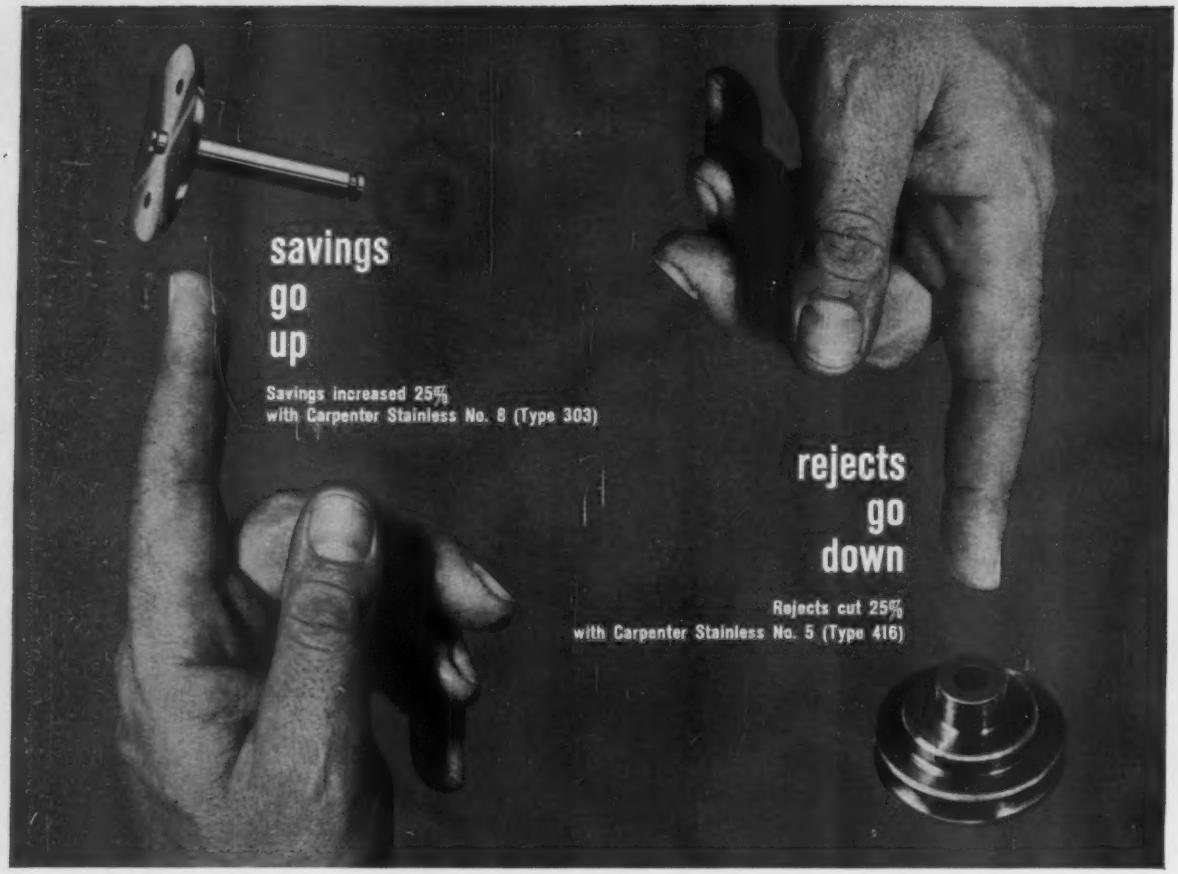
2. Wheel Support—The exclusive Microsphere bearing reduces sparkout time, speeds production.

3. Wheelfeed—Exclusive Microfeed® a pulse feed in millionths to final size meets your tolerances on a production basis.

4. Wheel Dressing—Exclusive Truform dresser with shake-free construction assures exact reproduction of all wheel profiles.

LANDIS

LANDIS TOOL COMPANY, WAYNESBORO, PA.



Two good "points" are working for you . . .

when you choose Carpenter Free-Machining Stainless

Find a way to increase production, and, at the same time, improve your percentage of "good ones" —and you've found the key to more profits. Carpenter Free-Machining Stainless points the way to both of these goals. The unexcelled machining qualities in Carpenter Stainless No. 5 (Type 416) and No. 8 (Type 303) enable you to run your machines at higher speeds, and run them longer . . . with less downtime for tool refinishing. Their consistent uniformity provides better finishes, closer tolerances, drastically reduces chatter marks and burrs . . . holding rejects to a minimum. These steels, developed in the same laboratories and mills that developed and produced the world's first free-machining stainless steels, are always available for immediate delivery from your nearby Carpenter Service-Center. Call Carpenter today . . . let us point the way to improved profit for you.

Carpenter steel

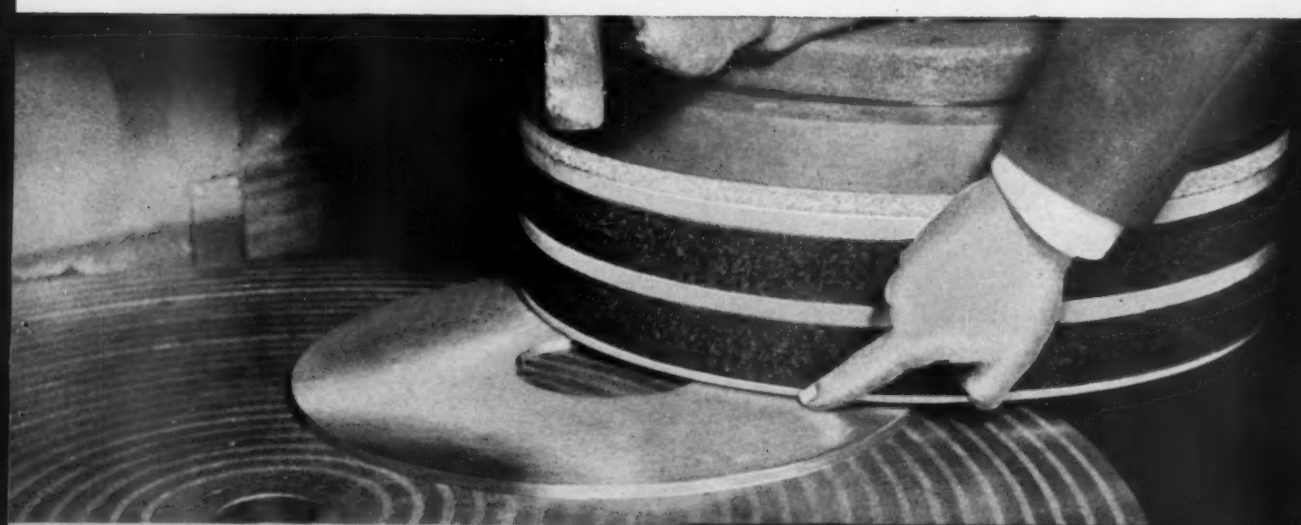
you can machine it ***consistently*** better with Carpenter Free-Machining Stainless

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

GARDNER TAPE BOUND WHEELS ELIMINATE DOWN TIME

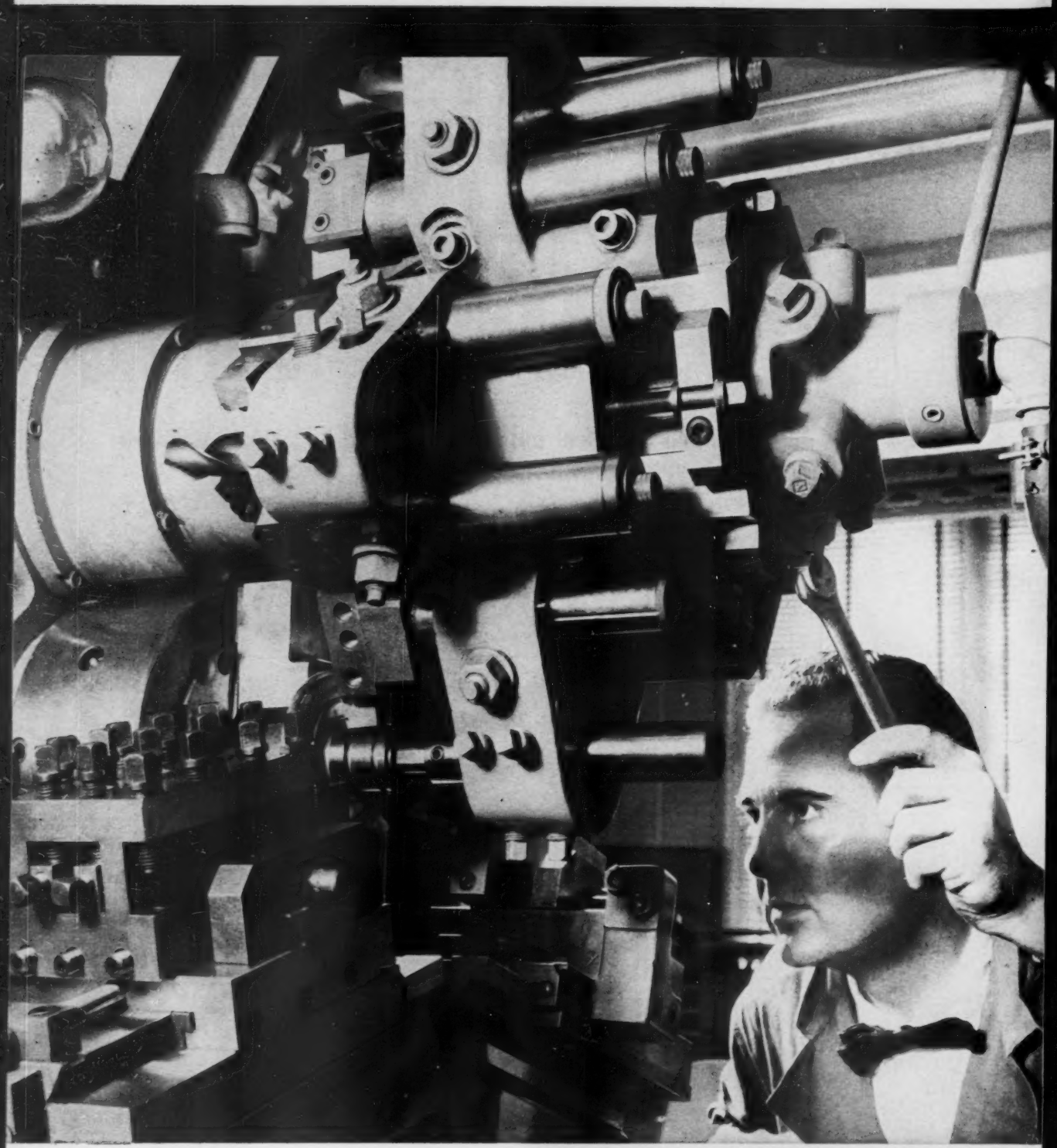
Glass fibre tapes remain on wheel until ground away . . . no production stoppages for cutting and removal

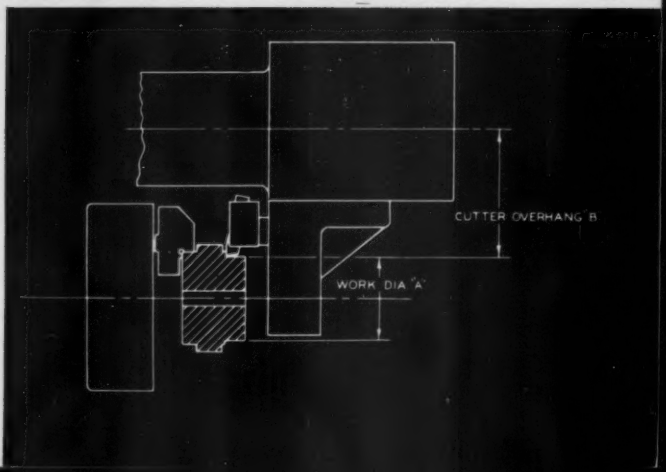
Gardner tape bound wheels now provide continuous, uninterrupted production by eliminating the need for costly stoppages to cut and remove wire binding.



GARDNER

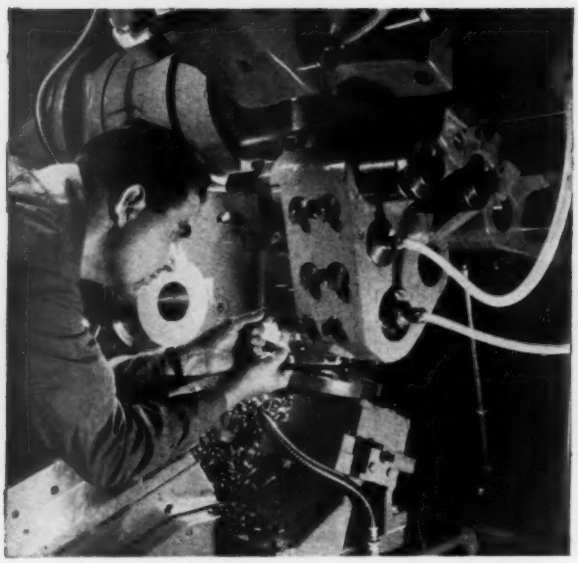
GARDNER MACHINE COMPANY, BELOIT, WISC.





The overhead design of the multiple turning head allows extra heavy turning cuts. Note that as work diameter "A" increases, and the cutting torque thus increases, that cutter overhang "B" decreases. As a result, torsional forces which cause deflection of cutter supporting elements also decrease. The larger the work turned on an "AC"—the greater the rigidity of the tool support.

Warner & Swasey Chuckers let you snug-up the tools for maximum rigidity



The operator secures minimum tool overhang by adjusting cutter holders to suit their respective lengths of cut, after he has clamped the multiple turning head as close to the work as the longest cut permits.

W&S Single Spindle Automatics are designed to operate with minimum tool overhang. This promotes good finish, preserves sharp cutter edges, permits extra-heavy turning cuts.

An "AC's" open tool area means more than easy access; it provides clearance between multiple turning heads and the cross slides. Thus, during setup, multiple turning heads can be shoved forward along the pentagon as close to the work as the longest cut permits.

Tool holders, clamped in through-holes in the turning heads, then project forward only the distance needed to position the cutters. Notice in the large photograph how the shanks protrude through the rear of the turning heads.

Result: minimum tool overhang and maximum rigidity.

"AC" rigidity is an advantage with a pay-off. It's just one reason to consider adding "AC's" to your shop. The Field Engineer will gladly give you the details. Or write The Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

Automatic Punch Riveters to meet your every need: from the 3" Throat portable model for hard-to-reach work areas, to 48" Throat model for large and irregular assemblies.

ARE YOU RIVETING (OR WELDING) YOUR PROFITS AWAY?

Then consider the advantages of "One Man-One Machine" operation with ACF-ERCO Automatic Punch Riveters: **1.** Operate at speeds up to 45 rivets per minute—4 to 11 times faster than other metal fastening tools or techniques. **2.** Reduce handling and die work—reduce scrap completely. **3.** Liberate up to 80% of existing manpower. **4.** Improve product strength and quality—reduce costly inspection. **5.** Increase consistency and uniformity of output. **6.** Pneumatically-powered, electrically controlled, human-engineered for maximum operator efficiency.

For specifications, free brochure or information on how ACF-ERCO Automatic Punch Riveters can achieve man-hour economies as high as 90% for you—write: ACF-ERCO Machine Tools, ACF Electronics Div., Riverdale, Maryland.

ACF ELECTRONICS
DIVISION

ACF INDUSTRIES

480

CIRCLE 265 READER SERVICE CARD

CIRCLE 266 READER SERVICE CARD ►

Brightening a tool room with the "Touch of Gold"

Don't let low grade equipment make your tool room a dark spot in your plant operation.

Brighten up with the modernizing, economizing "Touch of Gold" — built into all Norton grinders!

Here you see the five basic types of Norton tool room machines: universal grinders, hand or hydraulic surface grinders, cutter and tool grinders . . . and G & E shapers.

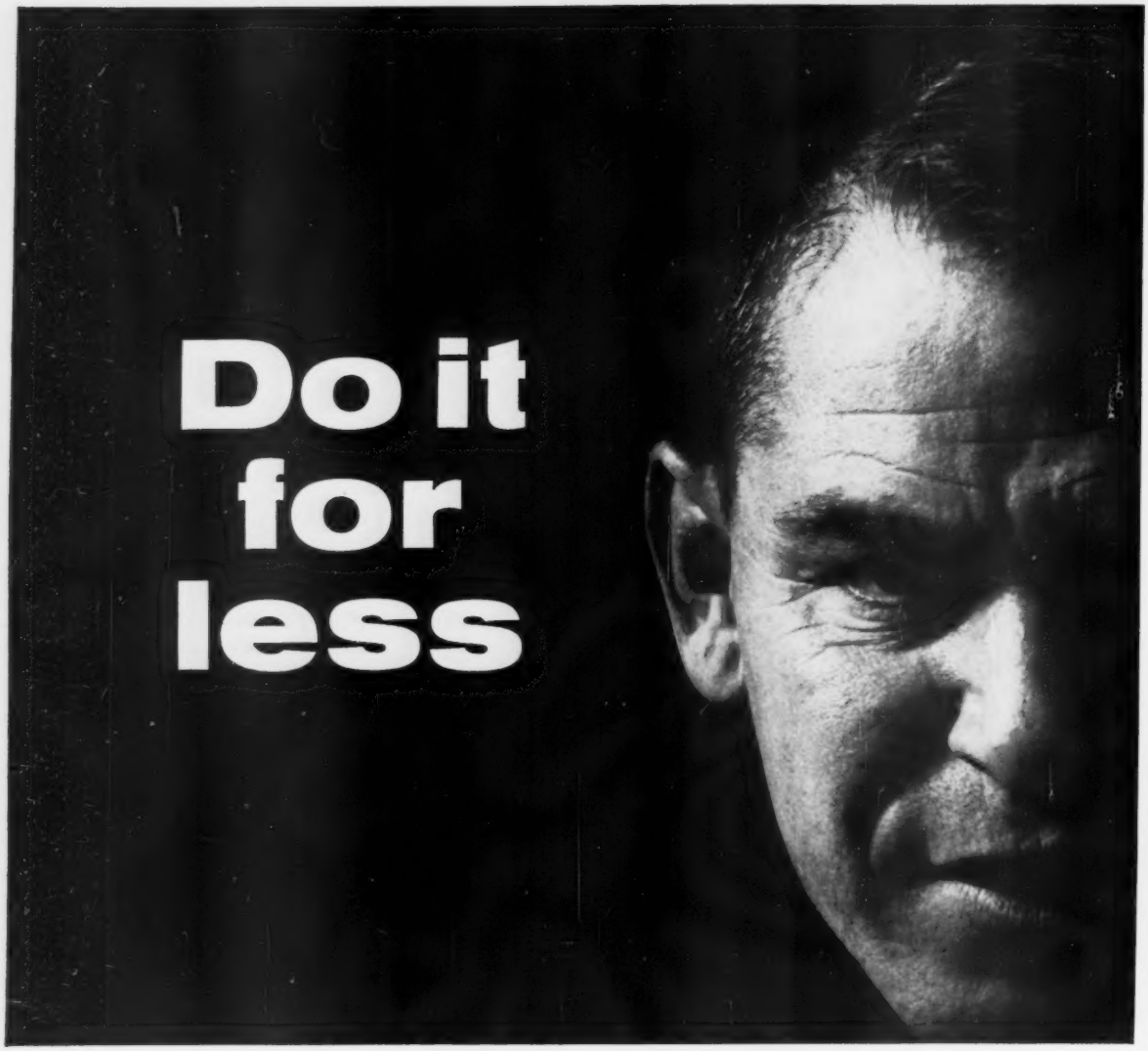
For faster, easier, lower cost grinding, all here include Norton-developed advancements — such as the cutter and tool grinder's tilting wheel head and the hydraulic surface grinder's work table speed of 150 feet per minute.

Your Norton Man will be glad to show you how "Touch of Gold" benefits can be added to your own tool room or production grinding. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass.

NORTON
MACHINE TOOLS

Making better products . . . to make your products better

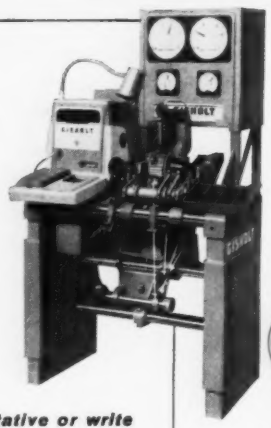
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



ON A GISHOLT BALANCER

Gisholt MASTERLINE 1S Balancer

Shown with separate unbalance location (angle) and amount meters for each correction plane.
Readings hold until corrections are made.
Complete plane separation.
Needs no special foundation.
Correction planes can be inside or outside work supports.
New HS line handles miniature, high-speed parts—impellers, armatures, gyros, self-driven assemblies.



Contact your Gisholt Representative or write for Catalog 1109D.

How long since you analyzed your balancing methods in light of recent developments?

One year? Two years? Take a fresh look. If you still rely on operator skill or judgment, accuracy suffers, time is lost, reject rates or field failures are high.

With Gisholt balancers, guesswork is eliminated. You can locate, measure, correct and inspect in *one handling*.

Only Gisholt offers all the advantages you need to do it for less.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

The 1960 Golden Anniversary annual report of Norma-Hoffmann Bearings Corporation, Stamford, Connecticut, outlines the impressive progress resulting from their long range capital improvement program. By the careful selection of reliable capital equipment compatible with a comprehensive quality control system, Norma-Hoffmann customers are assured of a consistently fine quality product.

AN INDICATION OF PROGRESS AT NORMA-HOFFMANN

. . . Bryant Centalign® Grinders

Important factors in progressive statistical quality controlled production are the Bryant Model "C" Centalign Grinders shown here in the Norma-Hoffmann plant. Straight bores and precision bearing raceways are ground on the Centaligns with consistent accuracy . . . at record-breaking production rates.

Progressive manufacturers throughout the world are improving their competitive position with Bryant Centaligns. Engineered for quick changeover and minimum down time, every one is thoroughly "proved out" at Bryant by statistical quality control methods. Find out how a Centalign Internal Grinder can help you.

BRYANT

Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

CIRCLE 268 READER SERVICE CARD

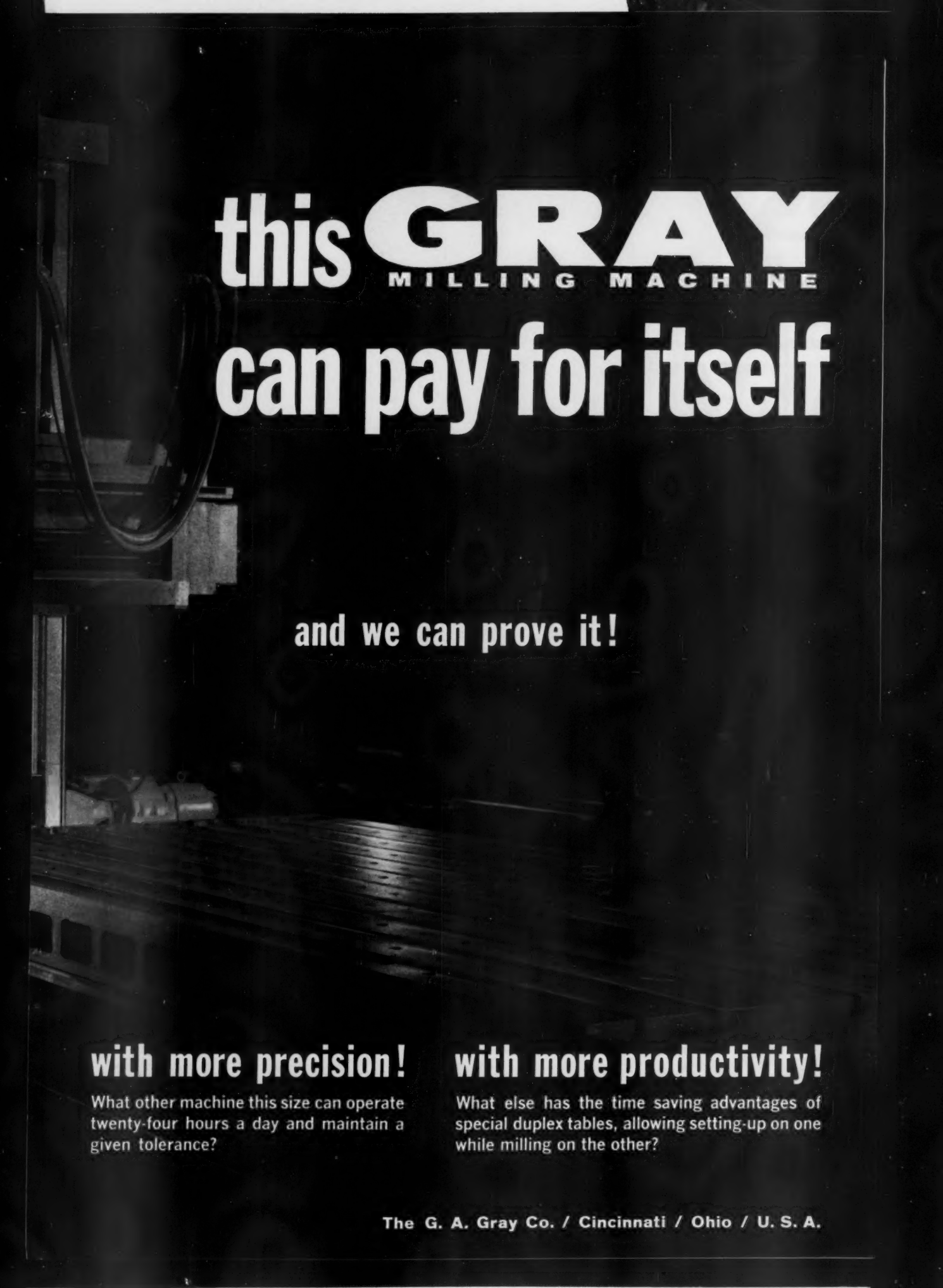
with more cutting power!

What other milling machine—planer type, has the flexibility of four 75 H.P. units heads, pouring a total of 300 H.P. into the job?

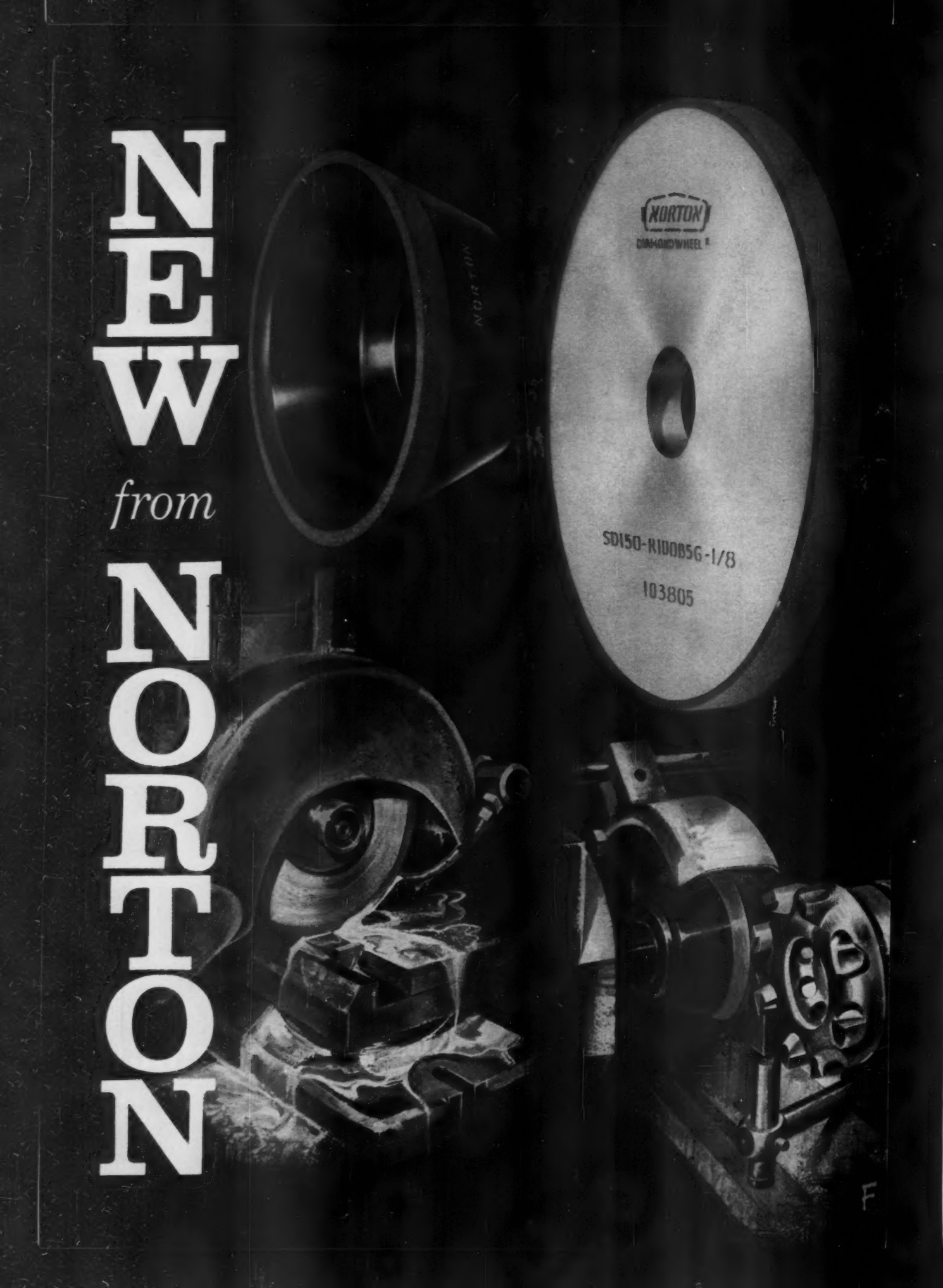
with more control!

What else has a numerical control positioning system that gives visual indication of movement of railheads and table?

horizontal milling and boring machines / planers / milling machines—planer type


this GRAY
MILLING MACHINE
can pay for itself
and we can prove it!
with more precision!
What other machine this size can operate twenty-four hours a day and maintain a given tolerance?
with more productivity!
What else has the time saving advantages of special duplex tables, allowing setting-up on one while milling on the other?
The G. A. Gray Co. / Cincinnati / Ohio / U. S. A.

NEW *from* NORTON



THE DIA-CROWN LINE...

with the first really new bond in all diamond wheel history!

...B-56, an unparalleled advancement for all carbide grinding ...wet and dry

Since Norton Company developed the first diamond wheels for industry in 1929 it has been the leader in diamond wheel progress — first the resinoid bond, then the metal and vitrified bonds.

Now comes another "first" from Norton, a brand-new bond, the B-56, an outstanding development combining greater productivity and economy for either wet or dry carbide grinding in ONE bond — providing the finest diamond wheels, the Dia-Crown line, ever produced for tool sharpening, die grinding and all other carbide toolroom or production jobs.

In test after test on the widest range of carbide grinding, wet and dry, in customers' plants, Norton Dia-Crown B-56 wheels have outperformed all other wheels with major results — per job — including the following:

- Increased volume of carbide removed, per unit of time.
- Longer wheel life without sacrificing speed of cut.
- More workpieces handled per wheel.
- Considerably lower wheel cost per cubic inch of carbide removed.

Believable? . . . It sure is! Look at these quotes from customer reports!

"Wheel was so good we could hardly believe it, and checked test results again . . . still showed 30% longer wheel life."

"This wheel reduced grinding costs from 13¢ to 7¢ per tip."

"An extremely fine wheel. Cuts more carbide in a given time than any other wheel."

"Best wheel ever used. Will convert to this for all our diamond wheel operations."

That's what our customers say — and it's due to this entirely new Norton resinoid bond a truly outstanding development. Norton Dia-Crown wheels with this new bond are available in all types and sizes for carbide grinding. Remember, too, that if two wheels of the same size and type have been required for wet and dry grinding — this ONE new wheel will now do both — wet *or* dry, reducing inventories and cutting costs.

Get complete facts on how this new Dia-Crown line of diamond wheels can improve your carbide grinding and save you time and money. See your Norton Man, a trained Abrasive Specialist, or your Norton Distributor. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

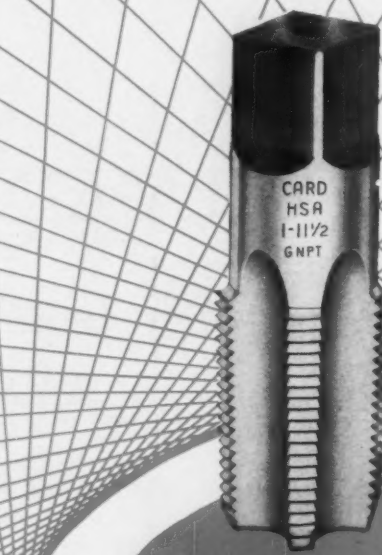
NORTON
ABRASIVES

W-2024

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

CIRCLE 272 READER SERVICE CARD



CALCULATED TO CUT COSTS

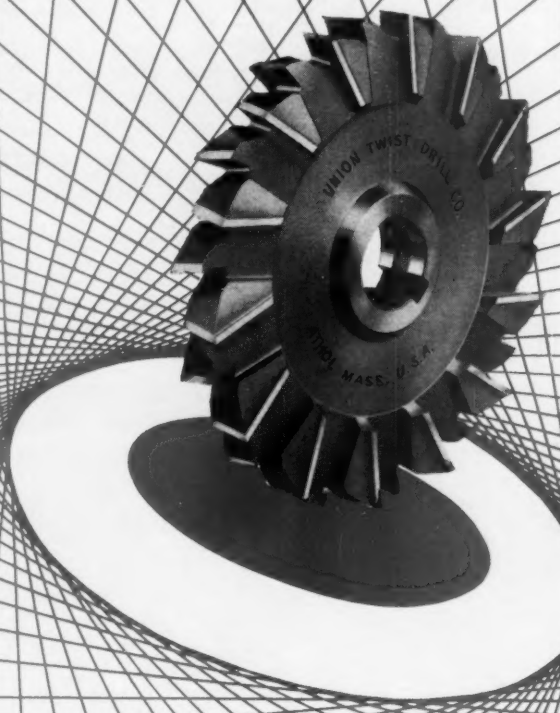
A truly geometric pattern is followed in precisely duplicating each CARD tap, according to type and size. For high volume, high quality production, specify CARD taps. Your CARD Distributor can make fast deliveries of the taps, dies, gages and screw plates you need. For helpful advice on their selection and use, call in your CARD technical man. CARD DIVISION, Athol, Massachusetts.
Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth,
Los Angeles, New York and San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 273 READER SERVICE CARD



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Production of UNION cutting tools is like geometric progression. Each UNION milling cutter of the same size and type is precisely duplicated. This exact duplication brings valuable production benefits to every user. For more dependable performance, longer service life, specify UNION milling cutters, drills, reamers, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

Card Division, Athol, Mass. Butterfield Division, Derby Line, Vt.

CIRCLE 274 READER SERVICE CARD

U.S. DUPLEX MULTI-SLIDE INCREASES OUTPUT *of assembled components* BY 746%

CUTTING PRODUCTION OPERATIONS BY 66%

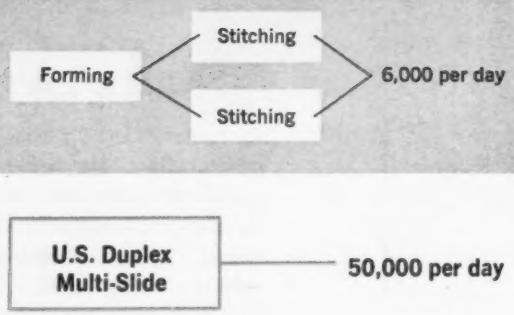
These are two of the benefits realized by the Precision Parts Section, General Electric Company, of Springfield, New Jersey, from just one U.S. Duplex Multi-Slide.

Until the installation of The new Symmetrical U.S. Duplex Multi-Slide, G. E.'s Precision Parts Section was producing complete rectifier plates at the rate of 6,000 per 8 hour day — in a 3 operator production set-up.

The U.S. Duplex Multi-Slide is the only symmetrical duplex machine of its type built.

Two or more parts can be produced simultaneously — and assembled where required.

Bulletin #36-A will be sent on request.

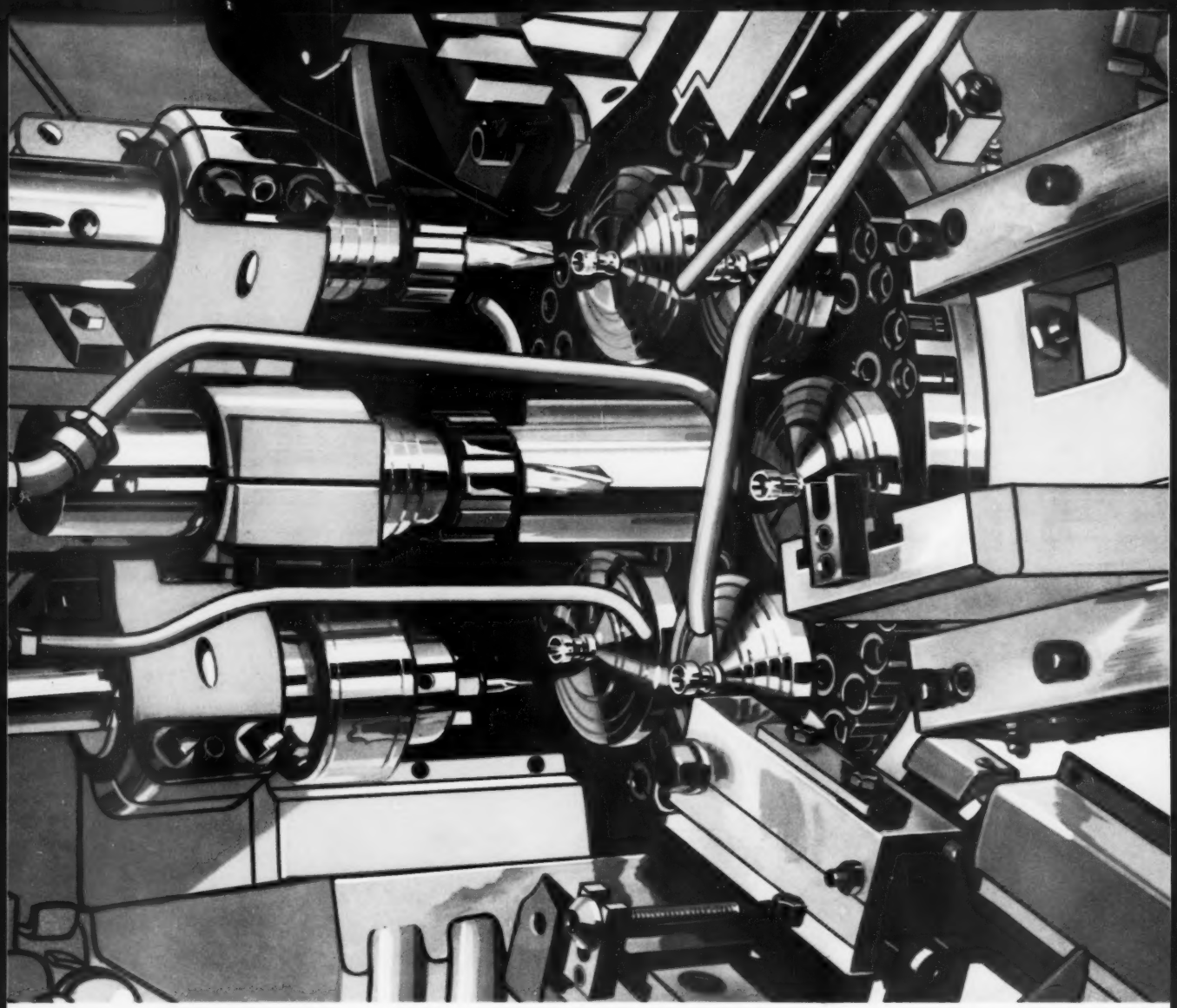


MULTI-SLIDE

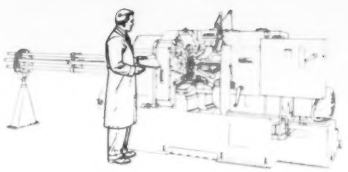
U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories



The newest bar machines *are New Britains*



How much work can you wring out of a bar machine? It depends on the machine, how it's tooled and who's using it. New Britain's New-Series Bar Machines are setting some pretty enviable productivity records right now. These machines, redesigned from the ground up, are the most advanced units of their kind available to the metalworking industry.

The four-spindle machines have capacity up to 5⅛″ and all the massiveness and power needed to turn work of this size.

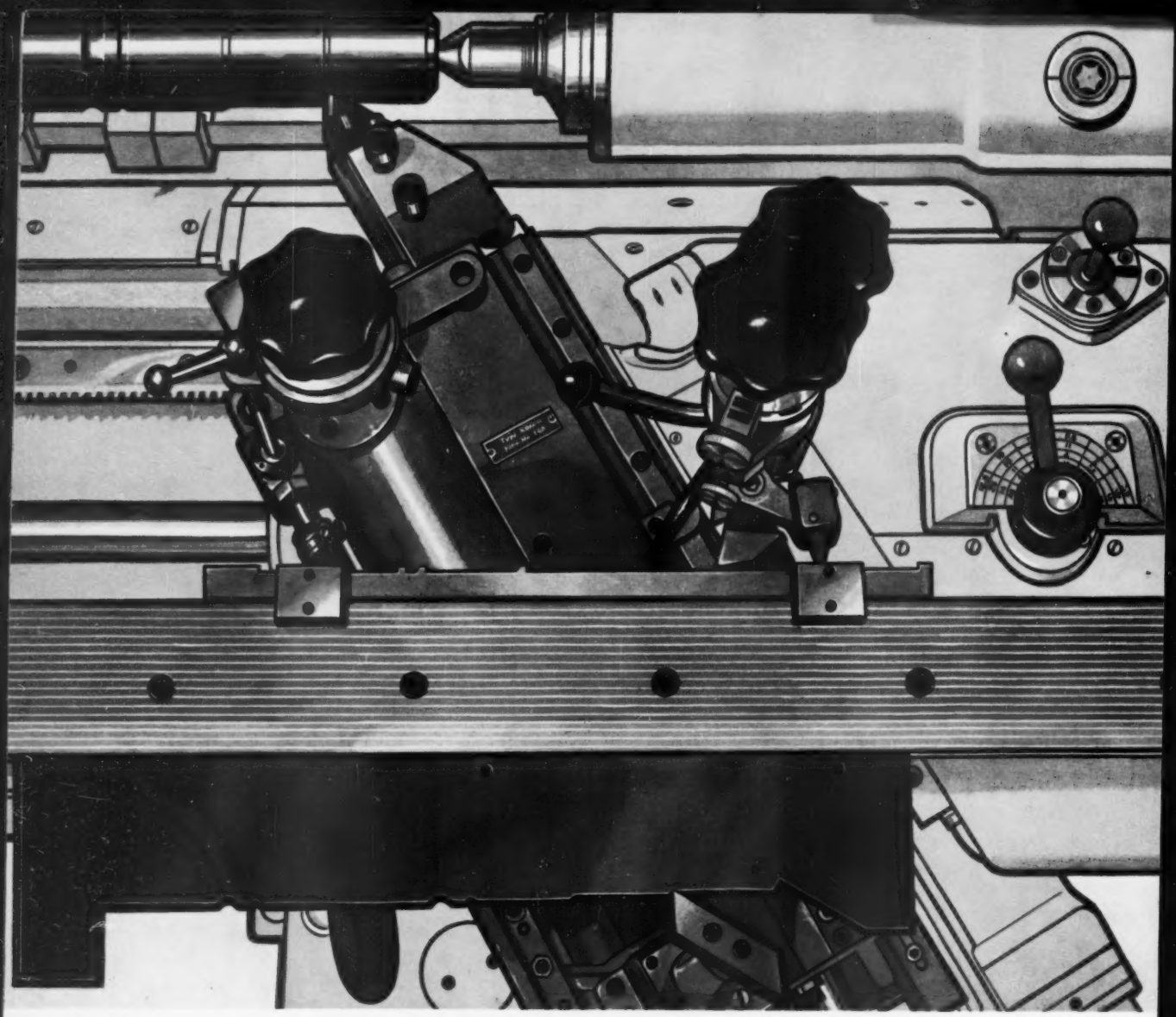
New series six-spindle machines in various models have capacities ranging up to 3½″. The eight-spindle machines take work to 2⅝″ capacity.

Increased capacity is only part of the story. Tooling combinations are practically limitless. With end-working and cross slide tooling in every position on every model, the greatest possible variety of operations can be performed to the highest order of accuracy. Numerous familiar New Britain features, like spindle carrier lifting and locating, have been retained and improved. A great many exclusive new features have been added.

Why not send for our new catalogs which give the whole story in detail or call your New Britain representative to arrange a demonstration?

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Fast set-up, quick changeover *with New Britain +GF+ copying lathes*

The basic design of a New Britain **+GF+** copying lathe can start to save you money on the first job you put on it. Because the single tool is guided by either a prototype or a template, set-up time is reduced to minutes. The single tool can be changed in minutes, too. Every dimension is positively transmitted from template or prototype to the work, making adjustment a simple matter of bringing only one dimension to size. A **+GF+** does a great variety of work—shafts, chucking work, internal *and* external copy turning. Backfacing is accomplished by a simple attachment. Multi-cut recycling for the removal of heavy stock concentration can also be provided.

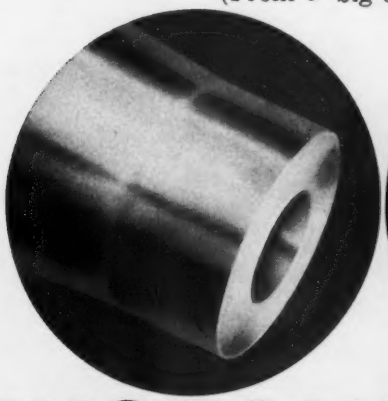
The versatility of application is pretty much limited only by the ingenuity of the individual. For more complicated jobs, New Britain can provide the most complete selection of steadies, special tooling attachments and other accessories available for any lathe anywhere. A complete range of models and sizes is available. Why not write for our new **+GF+** copying lathe catalog?

THE NEW BRITAIN MACHINE COMPANY

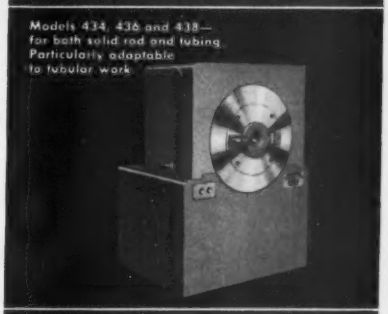
New Britain-Gridley Machine Division • New Britain, Connecticut

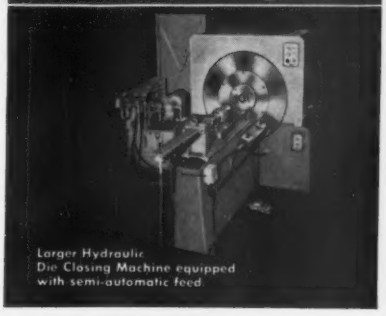
BIG...OR SMALL

(From 6" big to .008" small)



TORRINGTON ROTARY SWAGING MACHINES WILL DO THE JOB





Pointing, tapering, reducing or bonding metal parts? You can do the job faster at lower cost with Torrington Rotary Swaging Machines. The metal is shaped by hammering between dies. No stock is wasted. You get a full pound of parts from every pound of metal. You save time, metal and labor.

And you profit from the unparalleled engineering assistance Torrington provides. As the originator of the swaging process and the largest user of swaging equipment in the world, we can place at your service more swaging experience than any other company. Our experimental shops are available for working out your special problems. If you have a part that can be swaged we have the knowledge and skill to produce the dies to swage it. Bring your swaging problems to Torrington—we can provide the solutions. The Torrington Company, Swaging Machine Division, 200 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING

SWAGING HEADQUARTERS, U. S. A.

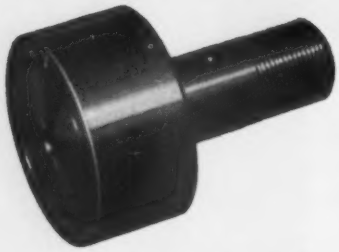
◄ CIRCLE 277 READER SERVICE CARD

CIRCLE 278 READER SERVICE CARD

VITAL AREA PROTECTION

extends bearing life of

McGILL® SEALED CAMROL® BEARINGS



- integral seals keep contamination out . . . lubricant in
- high radial and shock capacity in small space
- unit construction eliminates need for "building-up" improvised bolt and roller units
- available from stock

Positive sealing prevents two of the most common causes of bearing failure—foreign material on the vital bearing surfaces and loss of lubricant. SCF Series CAMROL bearings are sealed to keep dirt, grit and moisture out and retain lubricant. They are ideal for applications where the bearings are exposed to contaminants and in uses where re-lubrication is a problem.

A full complement of rollers and heavy outer race section provides maximum capacity and shock load protection in limited radial space. On a cost basis, sealed CAMROL bearings eliminate the need for procurement and assembly of components required in "building-up" improvised units for cam follower, track, guide and support roller use.

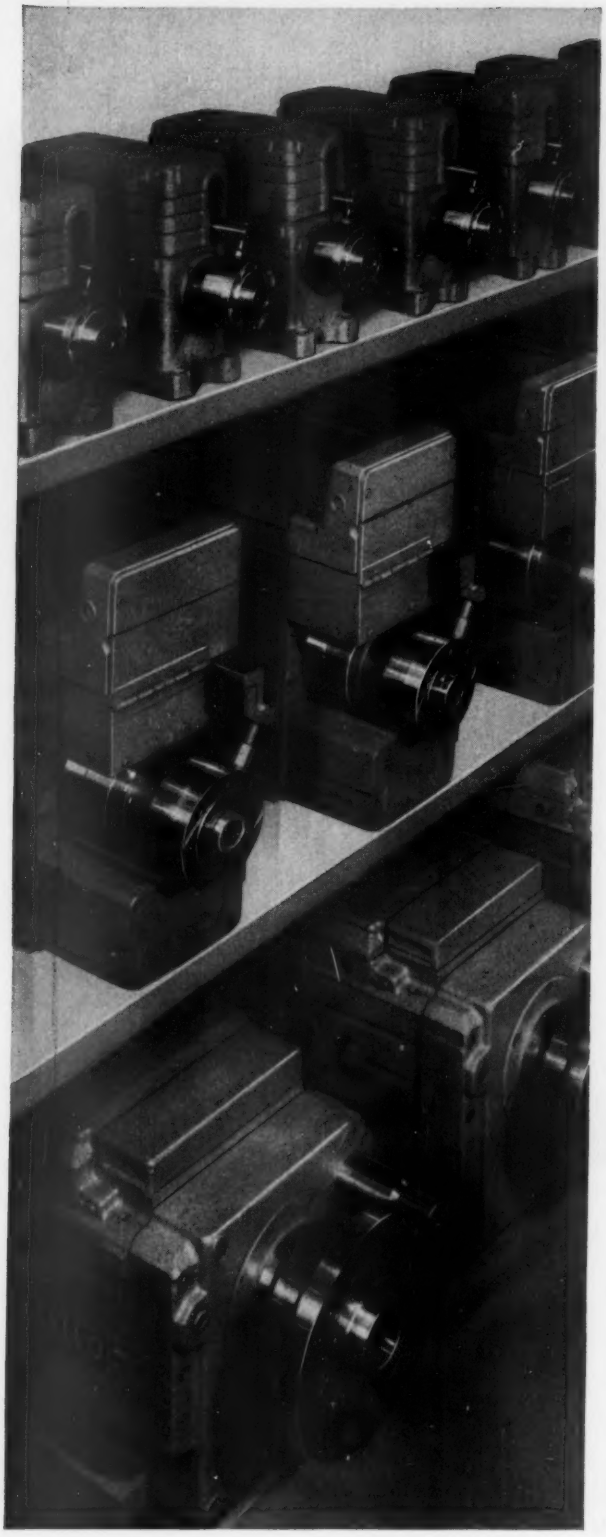
They are available from stock in roller diameters from ½" through 4" — and in a heavy stud series — both sealed and unsealed.

For complete data on McGill Bearings, send for Catalog No. 62-A.

CONSULT McGILL EARLY
IN YOUR PRODUCT R and D
specialized engineering saves time, improves design

McGILL MANUFACTURING CO., INC.
Bearing Division
300 N. Lafayette St., Valparaiso, Ind.

engineered electrical products
McGILL®
precision needle roller bearings



NEED Power Units in a Hurry?

Ex-Cell-O gives you off-the-shelf delivery!

In stock for immediate delivery, Ex-Cell-O Hydraulic Power Units are available in four quill-type models offering a wide range of spindle speeds, horsepower, stroke and thrust.

Self-lubricating for low maintenance, and precision-built for long life, Ex-Cell-O Hydraulic Power Units, and our Canadian-built lead-screw type Tapping Unit, are designed for drilling, reaming, tapping, spotfacing and other single or multiple operations, and for heavy-duty boring and milling machine applications. Pre-set start, rapid approach and return, dwell, reverse and stop are fully automatic.

Your Ex-Cell-O Representative has complete specifications, or write direct for our catalog. The model you need is on the shelf now—ready for same-day shipment to your plant!

61-21MA

EX-CELL-O FOR PRECISION

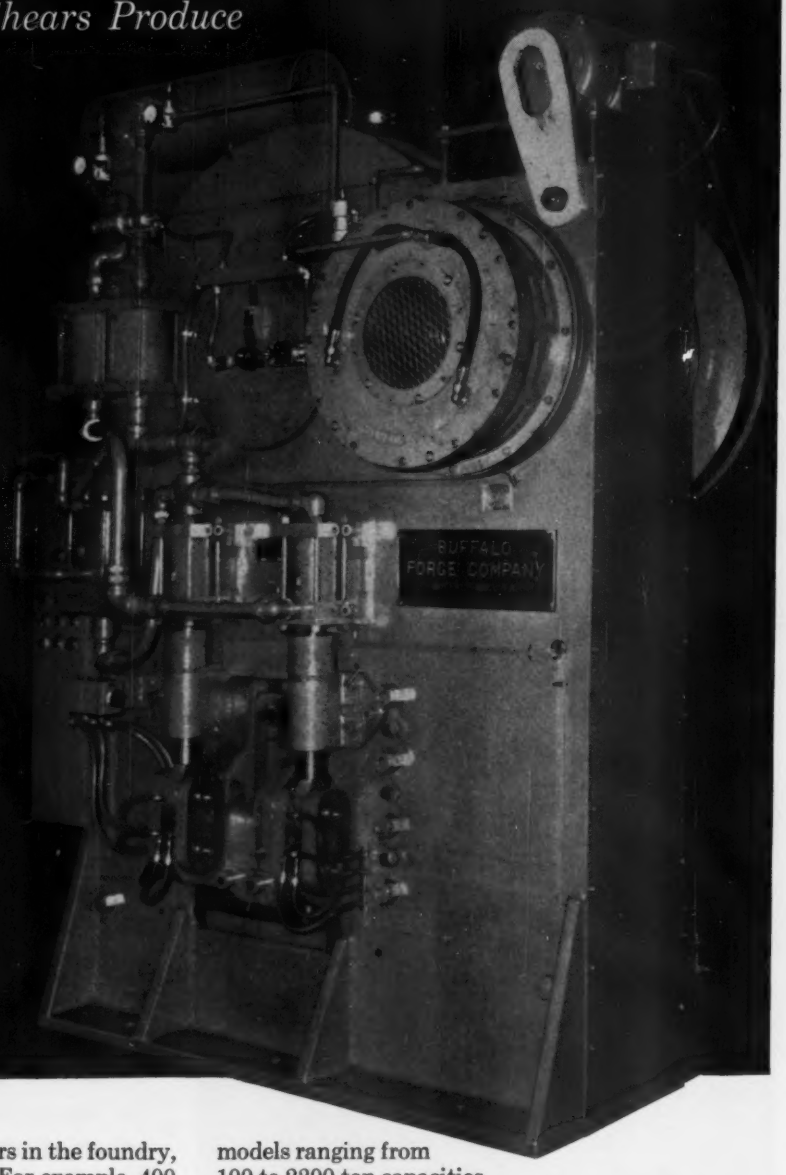
PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

'Buffalo' Billet Shears Produce

MORE CUTS PER BAR



The fastest-cutting production shears in the foundry, steel, and metalworking industries. For example, 400 ton model (illustrated) can produce up to 18,000 clean, square cuts (alloy steel) per eight hour shift.

Equally important... unique hold down and work support assure *maximum* number of cuts per bar with fewer rejects and minimum amounts of "unused" stock. Billets only 1½ times as long as their diameter can be cut in half... at full capacity in mild steel.

'Buffalo' Billet Shears are available in 8 standard models ranging from 100 to 2200 ton capacities. Rams are high strength alloy steel... adjustable knives are easily removed from rear of machine for sharpening.

Standard models include automatic air-operated oiling system, electrical equipment, and set of knives for round or square billets. Automatic feed tables are optionally available. Your 'Buffalo' Machine Tool dealer will be glad to furnish complete details. Or, write address below for Bulletin 711.

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

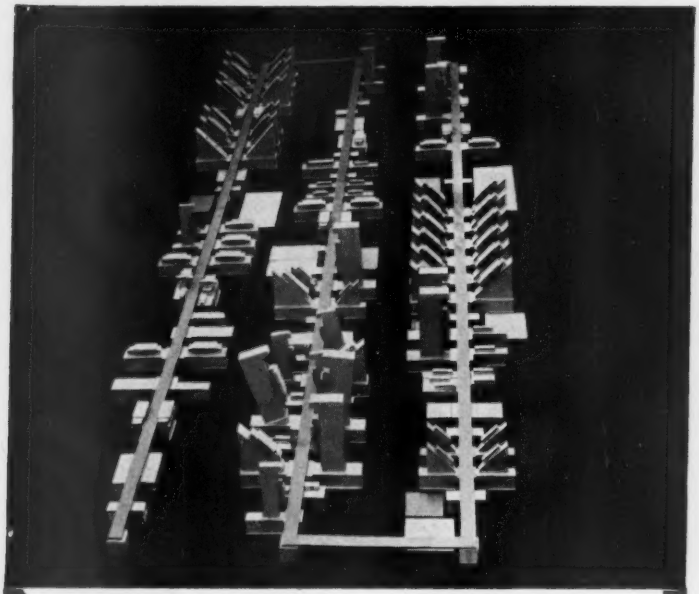
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

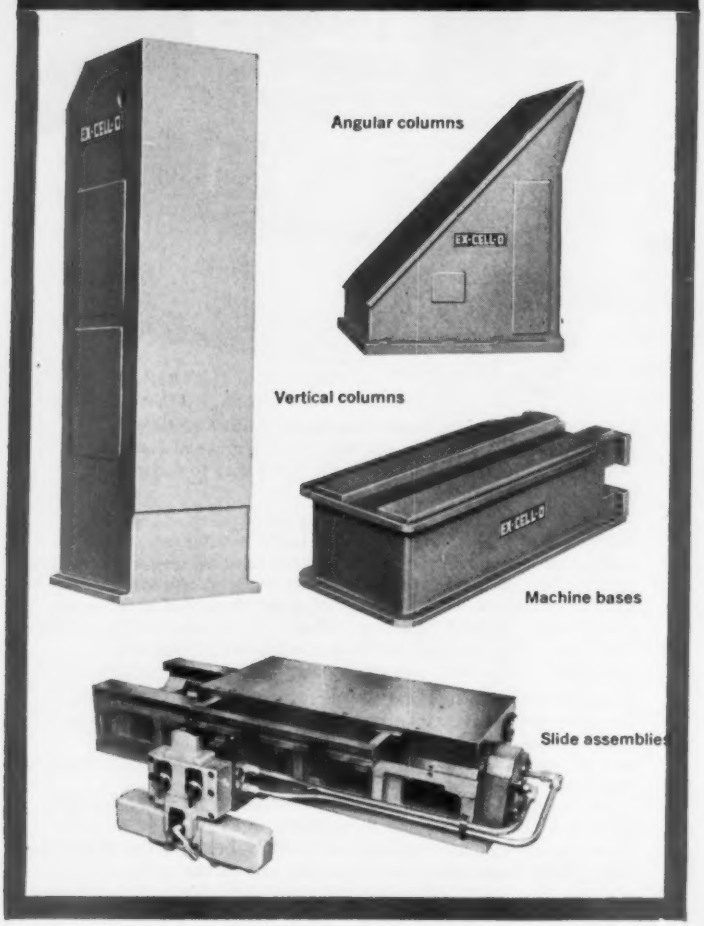
'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.





For economy, productivity, flexibility... EX-CELL-O BUILDING BLOCK UNITS!

- You get custom equipment, made from low-cost, standardized units.
- You can build simple one-way precision machines, or huge multi-station transfer machines.
- You can remove, relocate or add work stations to suit your production needs.
- You can arrange components for horizontal, angular, radial or vertical machining.
- You can partially or completely automate any sections.
- You can set up single or multiple functions—bore, counterbore, turn, drill, ream, face, chamfer and other operations.
- You can re-tool with standard Ex-Cell-O spindles, hydraulic power units and other accessories—and *know* all units will fit perfectly.
- You get faster delivery because standardization reduces engineering and build-up time.

If you're looking for manufacturing flexibility, look into Ex-Cell-O Building Blocks. Call your Ex-Cell-O Representative, or write for Bulletin 505911.

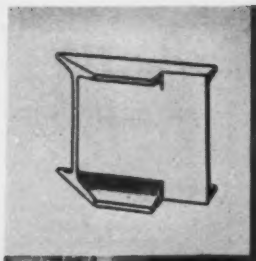
61-29M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



COPING AND MITERING HEAVY STRUCTURAL SHAPE

18" Beam (above) is held between vises for the short cut. On the long cut (left) vises were removed and beam held by simple clamp. The MARVEL Band Saw is truly indispensable in ornamental and structural iron shops where this type of work is done daily. The machine will cut-off square, miter and cope any work shape from the smallest moulding to 18" I-beams.

SPLITTING CLAMP RINGS, BUSHINGS

Splitting clamp rings, connecting rods, bushings and collets is a fast, simple operation on the No. 8 Band Saw. Perfect control, quick chucking facilities, accuracy and speed are features that especially fit the machine to handle this type of work.

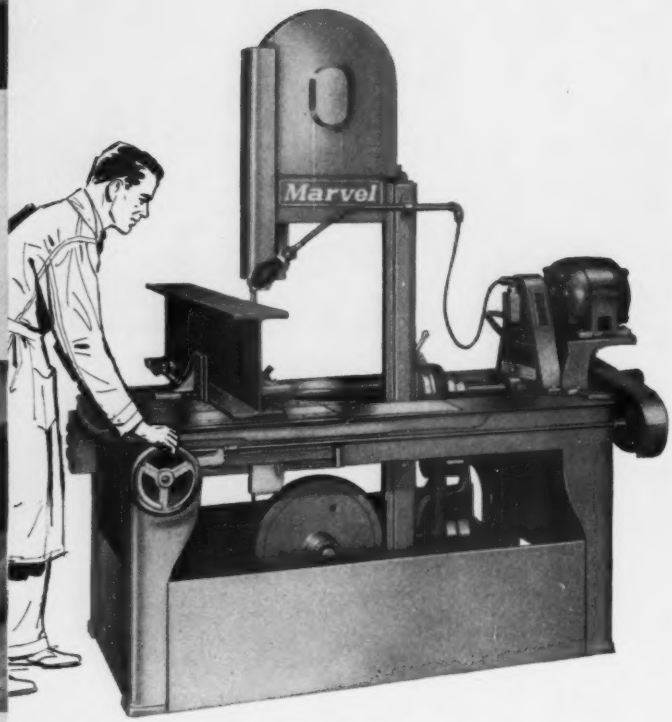
MITERING LARGE DIAMETER PIPE

Pipe (or any bar shape) may be mitered at a 45° angle without the need for special jigs or fixtures. Even when cutting miters, work remains in the same position as it does for straight cuts. Column and blade are instantly tilted to desired angle, even without stopping the machine. Perfect miters (or lesser angles) are sawed without any layout or special equipment.

SEGMENTING LARGE DIE BLOCK

Three equally spaced re-entrant cuts were made in this 16" x 18" SAE 4130 Forging. Job was completed, floor-to-floor in 5 hours. No special jigs or fixtures were required. An unusual job that serves to emphasize the versatility of the MARVEL No. 8 Saw.

"The One Machine We Couldn't Do Without"



"As simple to use and handy as a Scout Knife" is the way another user described his MARVEL No. 8 Universal Band Saw recently . . . and we can't think of a better way to describe this versatile metal cutting machine.

With a MARVEL No. 8 Band Saw, you can do almost any conceivable straight, angle, or miter metal sawing job—from cutting-off bar stock to making the most unusual forming cuts. You can handle small, delicate work, and in the next minute, saw structurals, or segment large work as illustrated in the lower photograph. You will save time, labor, and material with a MARVEL No. 8 Band Saw because no other saw has all the features to be had in this truly universal tool.

Upright column design and forward travel of the blade through the work (which remains stationary on the table-height saw bed) provides easy, unobstructed visibility and more convenient and efficient working conditions; column can be tilted and locked at any angle up to 45° left and right of vertical; the exclusive MARVEL Power Feed with Automatic Overload Relief; Automatic cutting-depth stops; simple, convenient operating controls—these are some of the features which make the No. 8 Band Saw the most useful—and used—metal cutting saw on the market.

For the complete story, ask or write for Bulletin 875 which illustrates and describes MARVEL Universal Metal Cutting Band Saws.

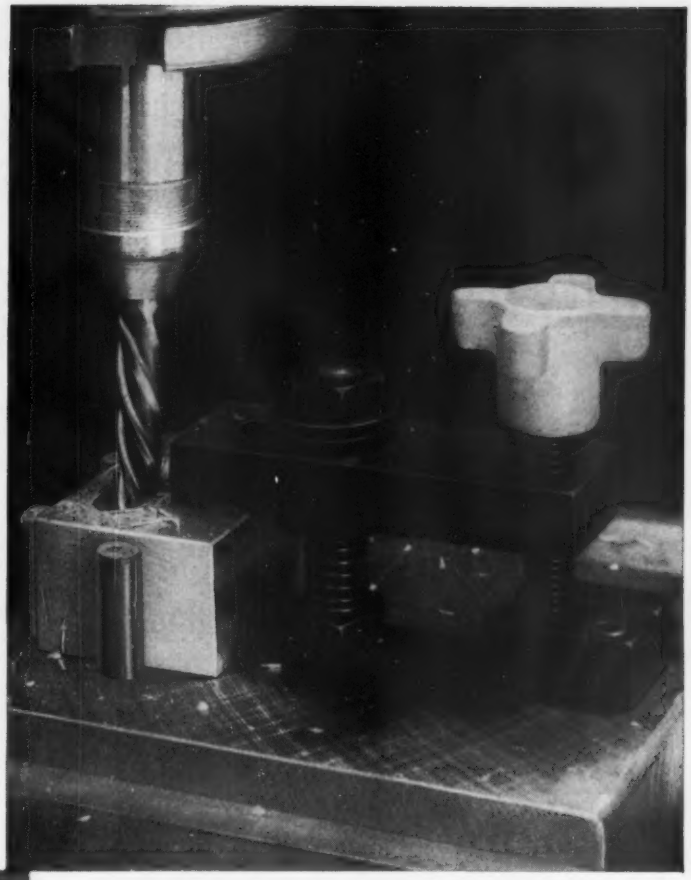
MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 N. BLOOMINGDALE AVE. • CHICAGO 39, ILL.

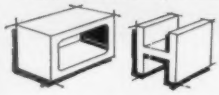
NOW

A Complete line of Jig & Fixture time-savers!

Ex-Cell-O Precision Clamp Assemblies and Standard Details for Fast, Economical Fabrication of Jigs and Fixtures

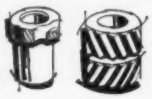


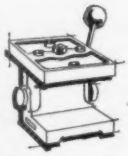
COMPONENTS FOR ALL YOUR JIG & FIXTURE NEEDS — AVAILABLE IMMEDIATELY FROM A SINGLE, RELIABLE SOURCE!



Micron Sections Machined cast-iron shapes cut to order.

Drill Jig Bushings Carbide or steel for metal and plastic jigs.





Lift-Swing Fixtures For fast drilling of difficult holes.

Reader service card number is for Fixture Components only; please request literature on other items separately.

Ex-Cell-O's new line of clamp assemblies, fixture details, spring plungers, torque screws and other fixture components gives you an unusually wide range of standard clamps and details in sizes and types to suit virtually every fixture-building need.

The complete cataloged line—from clamps and locks to plungers, locating buttons, handwheels and torque screws—is available from your local Ex-Cell-O Representative or Distributor, or direct from Ex-Cell-O. Phone TOwnsend 8-3900; TWX-DE 876; Wire ZTC.

BUYER'S GUIDE and PRICE LIST—Ex-Cell-O's new Fixture Component Catalog lists hundreds of parts and assemblies, specifications and prices. No cost or obligation. Send for it today!

61-208U

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Bushing Sales Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Precision Ground

Atrax SOLID CARBIDE TOOLS AND BURS

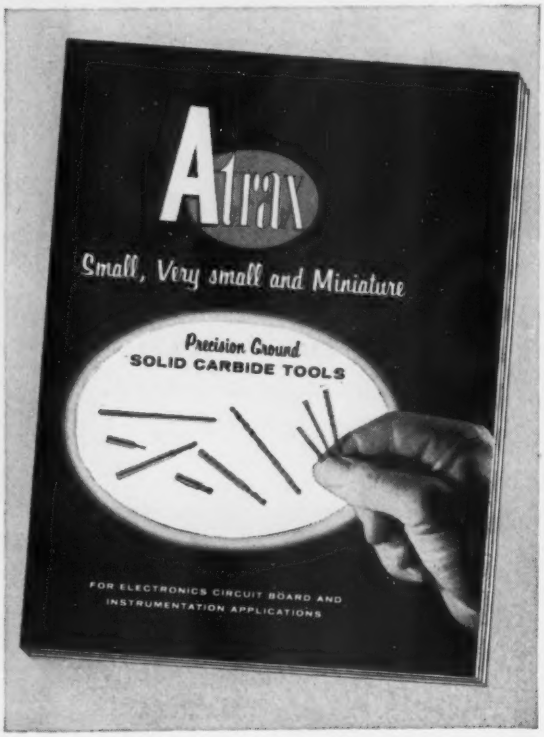
Job Applications

ATRAX LEADS IN ELECTRONICS & SPACE AGE SOLID CARBIDE TOOLING

NEW BROCHURE SHOWS

Small, Very small and Miniature

TOOLS FOR ELECTRONICS CIRCUIT BOARD AND INSTRUMENTATION APPLICATIONS



ATRAX MICRO-DRILLS
Wire Sizes #40 through #80.

ATRAX DRILL BLANKS
Wire Sizes #40 through #80.

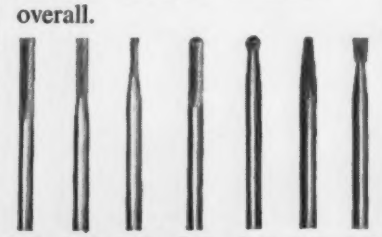
This brochure is available free. It's a guide for selecting and ordering carbide tools for practically any operation on conventional materials as well as abrasive plastics, fibers, synthetics, laminates and exotic materials and alloys.

ATRAX MINIATURE END MILLS
From 1/32" to 1/8" diameter in 2 flute and 4 flute series.

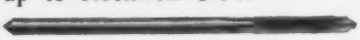
ATRAX MINIATURE STUB ROUTERS
Recommended for routing glass epoxy materials, Fiberglas, phenolics, bakelite, fiber and other synthetic materials.

ATRAX MINIATURE HOLE GRINDING BURS
Hole finishes of 2 microinches or better can be expected using these burs.

ATRAX MIDGET BURS
All burs with 3/32" shanks, 1¼" overall.



ATRAX MINIATURE MICRO-REAMERS
In Fractional and Decimal Sizes. Recommended for all materials up to Rockwell C-56.



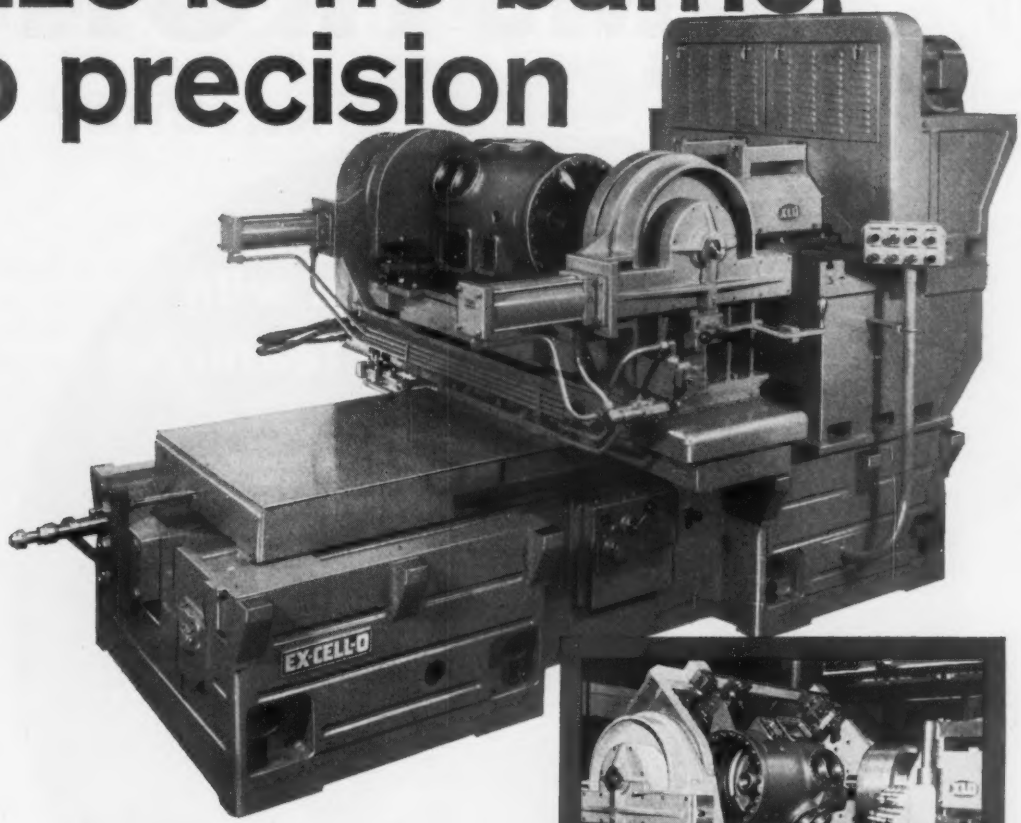
SEND FOR THIS NEW BROCHURE NOW!

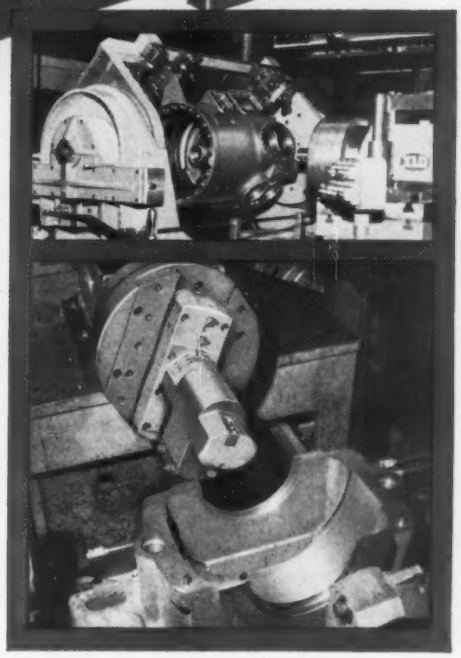
It will help you to longer tool life, improved tolerances and greater production on hard-to-cut materials.

INDUSTRIAL DISTRIBUTORS — YOUR RIGHT HAND OF PRECISION

THE ATRAX COMPANY
240 DAY STREET
NEWINGTON 11, CONN.

Size is no barrier to precision





HERE'S WHY SIZE IS NO BARRIER TO STANDARD EX-CELL-OS . . .

- Accuracy, heavy cuts and good finishes on large parts are the high-production features of Ex-Cell-O Models 771 and 772 (double-end) Horizontal Precision Boring Machines
- These precision-built workhorses have husky nickel cast-iron bases with wide-spaced ways, extra-strong tables to handle the heaviest fixtures and workpieces, and infinitely adjustable hydraulic feeds in both directions for maximum cycling efficiency.
- A range of standard spindles, bridges and drive equipment lets you custom-equip Models 771 and 772 to suit your particular precision boring, turning, facing, grooving and chamfering operations.

Contact your Ex-Cell-O Representative or write direct for details.

Typical of parts handled by Models 771 and 772 are large air conditioning compressor housing castings (main illustration and close-up above), and cast-iron pillow block bearing support housings (bottom photo). Machine takes ⅝" cut as it roughs, finish-bores, and generates interior form of support housing in a single cycle.

61—59M

EX-CELL-O FOR PRECISION

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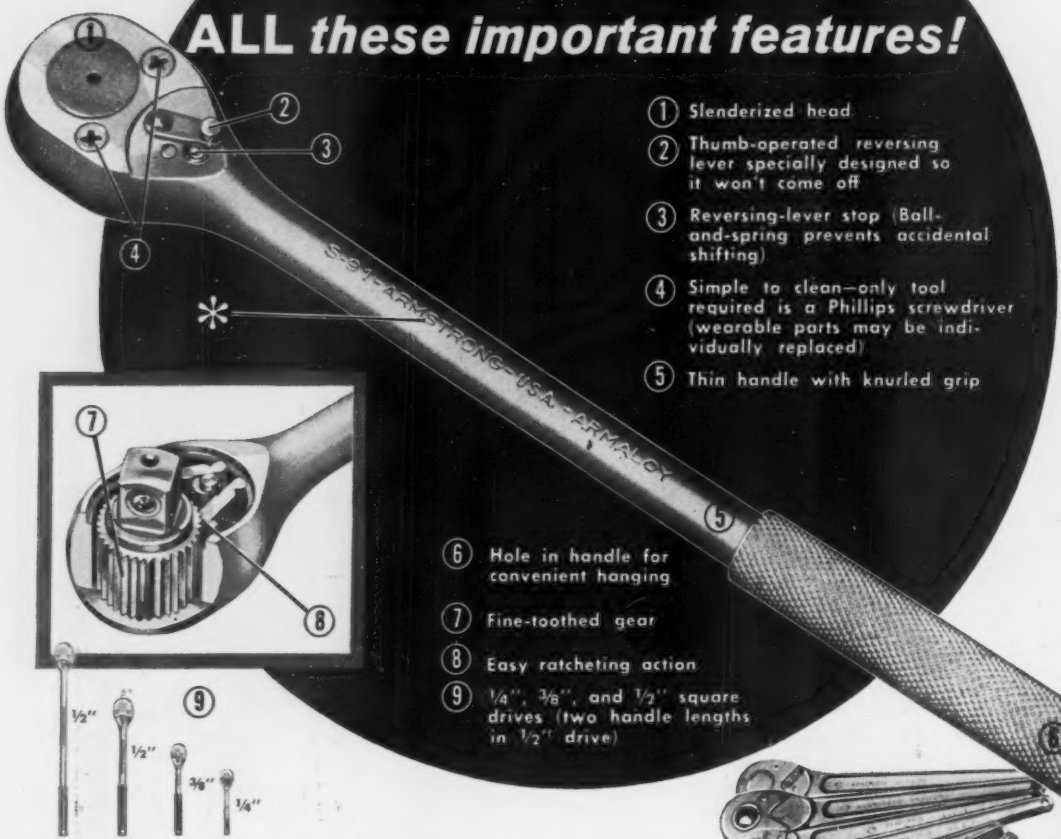
Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

New ARMSTRONG "90" SERIES RATCHET

The ONLY *Ratchet with* ALL *these important features!*



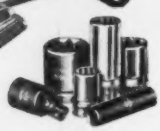
1. Slenderized head
2. Thumb-operated reversing lever specially designed so it won't come off
3. Reversing-lever stop (Ball-and-spring prevents accidental shifting)
4. Simple to clean—only tool required is a Phillips screwdriver (wearable parts may be individually replaced)
5. Thin handle with knurled grip
6. Hole in handle for convenient hanging
7. Fine-toothed gear
8. Easy ratcheting action
9. ¼", ⅜", and ½" square drives (two handle lengths in ½" drive)

All wearable parts of ARMSTRONG Ratchets can be replaced individually, inexpensively, and easily. Entire ratchet handles need not be replaced in the event of tooth wear, as is necessary with ratchets in which the teeth are formed in the head of the handle.

* The name ARMSTRONG on these fine tools is your assurance of highest quality. Manufactured under strict quality control, all ARMSTRONG Tools can be used with confidence.

Extra heavy duty "50" Series ARMSTRONG ratchets (illustrated at right) are manufactured in 1", ¾", ½", and ⅜" square drive sizes. For complete information on these, as well as the approximately 5500 other tools in the ARMSTRONG Line, see General Catalog #700. Your local ARMSTRONG Distributor can supply you with Catalog #700 and can show you the new "90" Series Ratchets. If you do not know who handles the ARMSTRONG Line in your area, we will be glad to furnish this information upon your request.

EXTRA HEAVY DUTY RATCHETS



SOCKETS

WRENCHES

WRENCH SETS

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

5215 W. ARMSTRONG AVE. • CHICAGO 46, ILLINOIS

Quality Controlled at Every Step!

Production parts bored, counterbored, spot-faced, milled, drilled, hardened and ground to your precise specifications

Check an Ex-Cell-O process sheet on any Ex-Cell-O precision production part, and you'll find that at every step, quality control is an important part of Ex-Cell-Ability.

Ex-Cell-O metallurgical laboratories test each run of stock and maintain a close watch on heat treatment methods and results. Non-destructive testing closely follows many Ex-Cell-O machining processes, and production inspection stations use the most modern equipment available.

If precision parts and assemblies are important to your product, your local Ex-Cell-O Representative has a quality control story that will be of interest to you. Call him soon, or simply send us your prints or requirements for a prompt quotation.

These precision parts are produced in volume, yet they are quality-controlled to custom work standards. Large photo above shows typical inspection equipment—a 30-inch Ex-Cell-O Contour Projector used to inspect parts at 100X magnification.

61-32J

EX-CELL-O FOR PRECISION

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Precision Parts Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Spindle Speeds	INFINITE (from 43 to 3500 RPM)
Horsepower	CONSTANT
Torque	HIGH
Finish	ULTRA-SMOOTH

An exclusive coaxial spindle design combined with a unique, beltless-type, mechanical variator drive unit (5 HP), enables the Micro-Turn Lathe to deliver constant horsepower throughout entire speed range, actually maintaining drive speed output within two-tenths of one percent. Built-in torque responsive mechanism positively prevents slippage even under starting or shock loads. Maximum torque is assured at low speeds for heavy cutting, with super-smooth operation at highest speeds for ultra-fine finish, all complemented by the Micro-Turn's rigid construction and supreme balance.

Features include:

- pushbutton control with direct reading tachometer
- spindle speed ranges changed by pushbutton . . . without stopping spindle
- exclusive feed converter unit, located in apron, providing simple conversion from standard to optional feed ranges without affecting standard thread ranges
- double-wall, one-piece, totally enclosed apron
- fail-safe pressure lubrication to headstock, gear box and end gearing
- pressure lubrication to carriage and cross slide ways provided by pump located in apron; one-shot plunger to lubricate cross slide ways when carriage is stationary
- choice of manual or automatic coolant operation
- hardened and ground leadscrew, cross feed screw and compound rest screw

For the complete, illustrated story on the revolutionary MICRO-TURN, write today for your copy of Bulletin No. 222. Nebel Machine Tool Corporation, Lathe Division, 3407 Central Parkway, Cincinnati 23, Ohio.

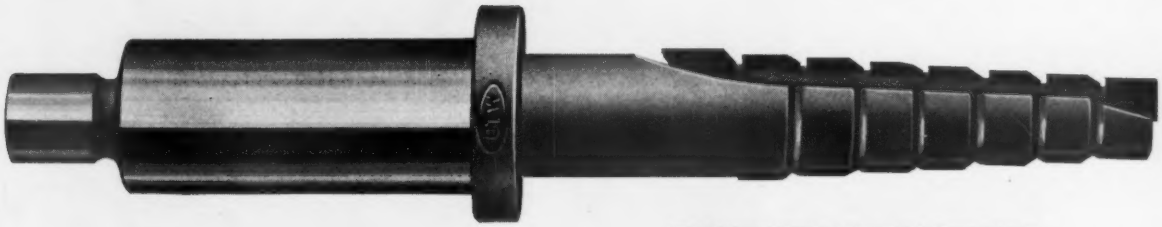
NeBEL

MICRO-TURN*

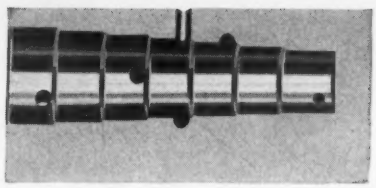
HIGH SPEED PRECISION LATHE

*TM Reg. U. S. Pat. Off.

Seven Diameters . . . from solid to finish with one tool, one pass!

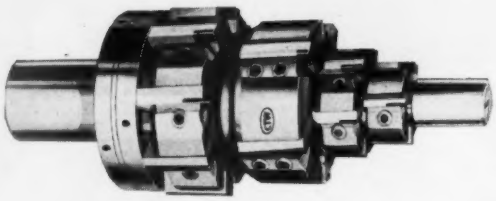


Special CTW Bor-Reamer bores and chamfers seven diameters from solid to finish in one operation. Tool is carbide-tipped, uses carbide bearing pads to maintain .001" tolerance on bore size and concentricity. Cut-away photo at right shows ID detail of non-ferrous aircraft part.



Imagine the setup and machining time *you* might save with a single Continental Special Cutting Tool custom-designed to combine two or more operations, to take multiple cuts, or to mill complex contours!

Why not let CTW combine your operations on production or short-run jobs? A call to your local CTW Representative will immediately put 40 years of cutting tool research, engineering and manufacturing experience to work for you. Call him today, or write direct for details.



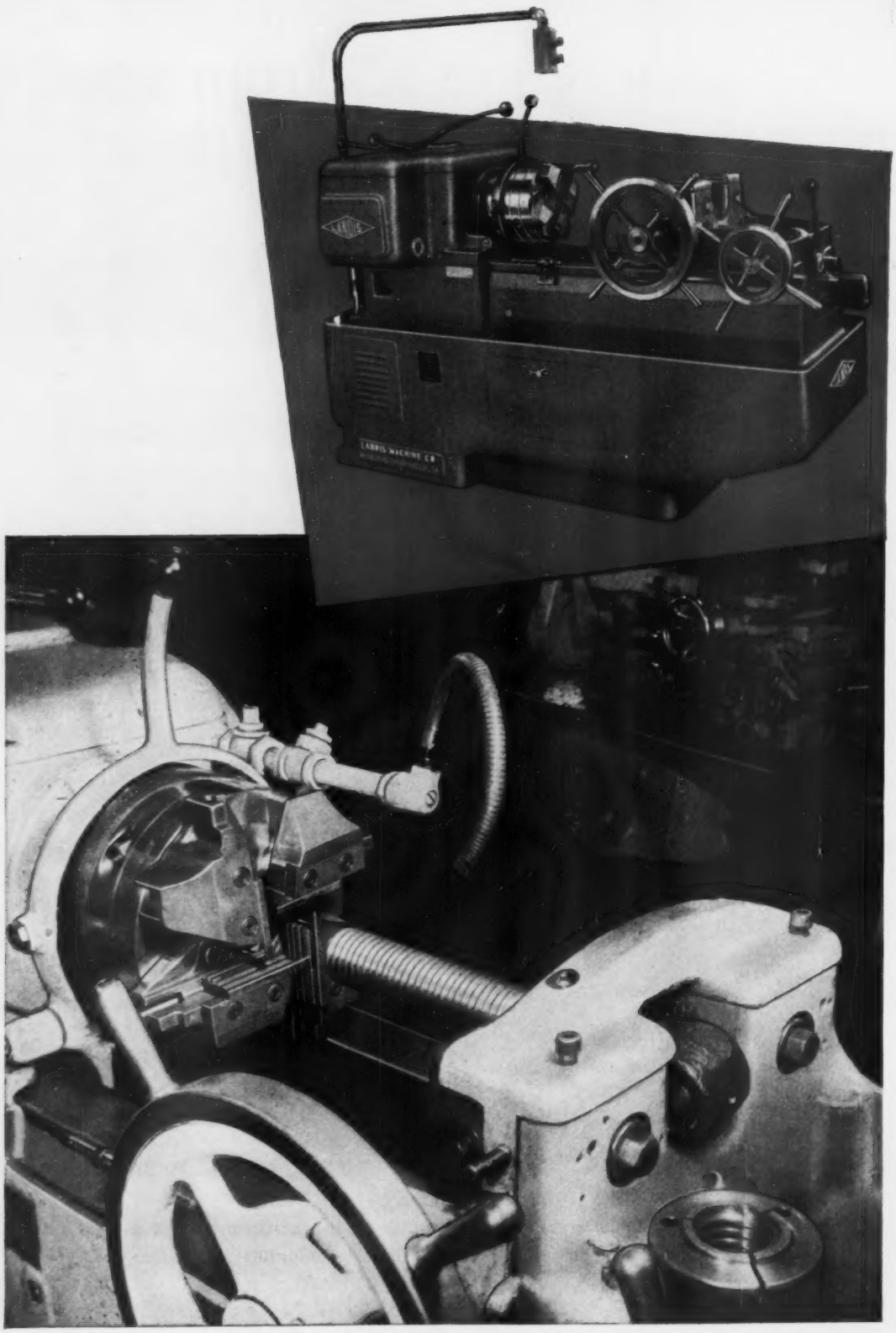
Inserted-blade special cutter, left, finishes four diameters and four shoulders in one pass. Tungsten carbide-tipped cutter at right combines two-step boring, hollow milling and plunge-facing in one tool.

DESIGN FEATURES TESTED IN EX-CELL-O'S OWN MANUFACTURING PLANTS . . .
PRODUCTION-PROVED IN CUSTOMERS' PLANTS THROUGHOUT THE WORLD!

61-34C

Continental CTW TOOL WORKS DIVISION OF EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

*TM Reg. U.S. Pat. Off.



461-C -2

coarse threads

cut in one pass with LANDMACO machines

The cutting of large diameter Acme threads at the Iowa Manufacturing Co. of Cedar Rapids, Iowa, illustrates the heavy duty threading possible on LANDMACO Threading Machines.

1045 steel forgings of 20-29 Rockwell C are used in the production of adjusting screws for construction equipment. 2¼"-3 pitch Special Acme threads (EXTRA DEEP) are cut 10" long, with a .026 pitch diameter tolerance and a .001 per inch allowable lead error.

Cutting at a speed of 7.6 surface feet per minute, 12.5 pieces are completed per hour. This includes 100% gaging on the machine, using go-and-no-go gages. Despite the large amount of metal removal, at least 80 pieces are produced between chaser grinds.

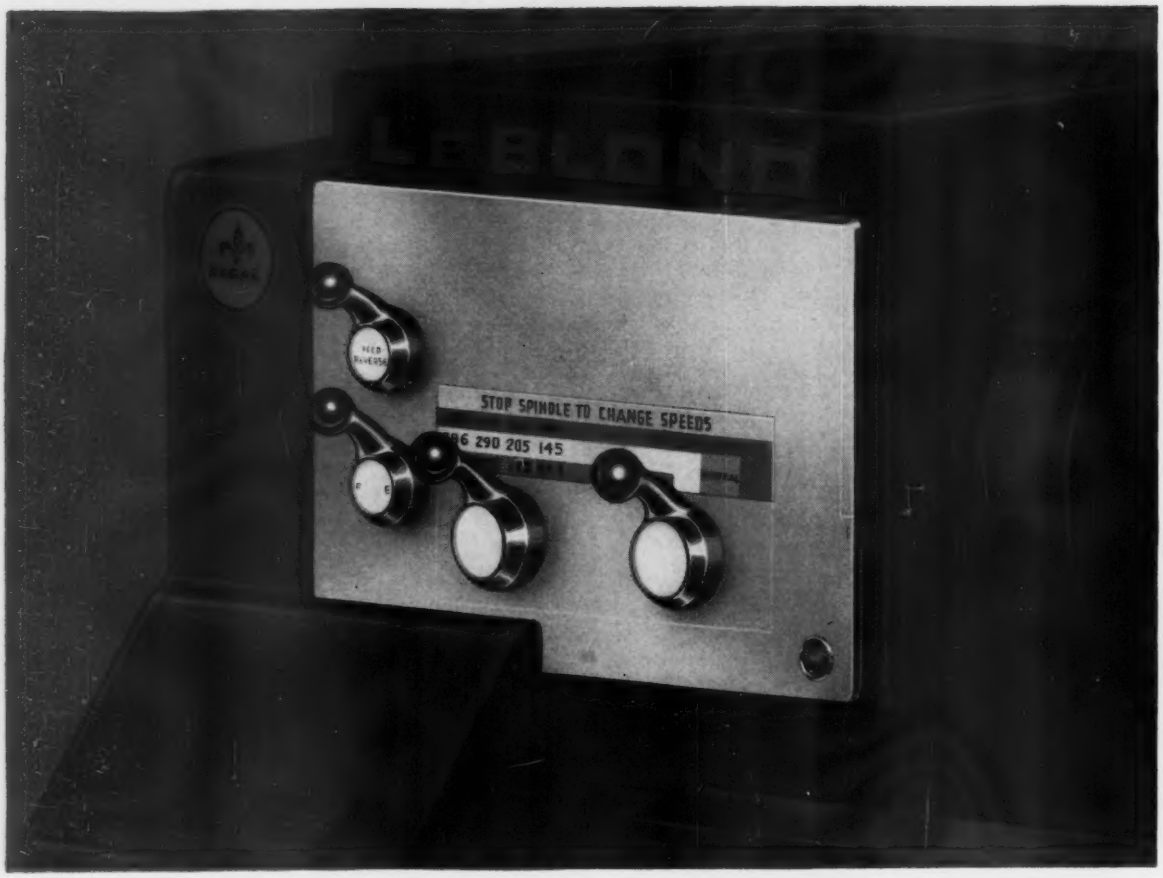
This job is an excellent example how such heavy-duty threading can be done with the LANDMACO Machine. The 2½" Single Spindle Machine (½" to 2½" range) used here features heavy construction, hardened-and-ground ways, lead screw attachment, and is equipped with a rugged LANCO Tangential Chaser Die Head. Roughing-and-Finishing Centering Throat Chasers produce heavy cuts in one pass of excellent finish, eliminate the out-of-roundness common in long heavy workpieces, and provide low tool cost.

LANDMACO Machines offer precision and heavy duty threading within a range of 3/16" to 6⅝" in diameter. For more detailed information, please send specifications when writing.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

LANDIS Machine COMPANY WAYNESBORO PENNSYLVANIA

new concept in Lathes



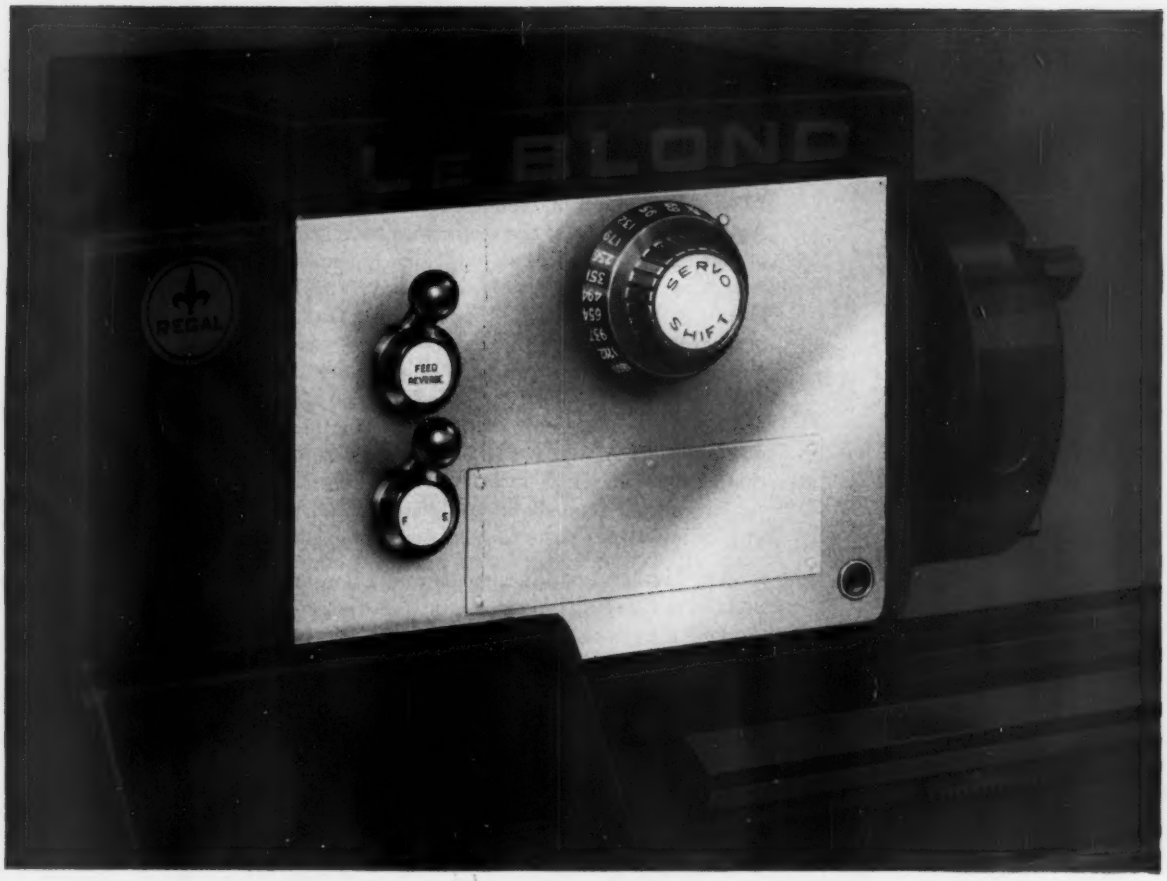
buy REGAL with manual shift....

Are you dubious about the advantages of hydraulic shifting on small lathes? Ingenious design of the new LeBlond Regal headstock lets you start with manual controls and add hydraulics in your shop at any time in the future! It's like having your cake and eating it, too.

The cost of adding the Servo-Shift package in the field is modest — just slightly more than original factory installation.

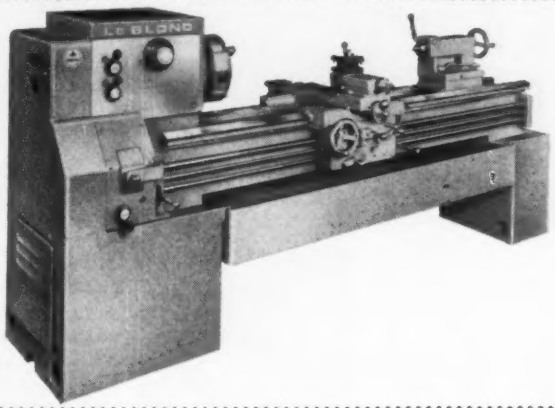
Brand new Regal Servo-Shift makes speed changing faster and easier than ever before. You select your next spindle speed while still cutting. Then move the control lever to brake position and get almost instantaneous automatic shifting—*with no clashing of gears!* This is the fastest and safest hydraulic shift available in a lathe today! It's simple and foolproof! It will make a hero out of every operator!

Our new Regal — the low-cost lathe with big-lathe features — has many more important advantages *not available in any other machine* of the same class. Ask us to have a LeBlond field engineer stop and tell you about them, or write for our new descriptive Bulletin R-961 A.



.....add SERVO-SHIFT later!

New LeBlond Regals are now available with 13", 15", 17" or 19" swing, and either manual or Servo-Shift.



World's largest builder of a complete line of lathes.

LeBLOND of Cincinnati

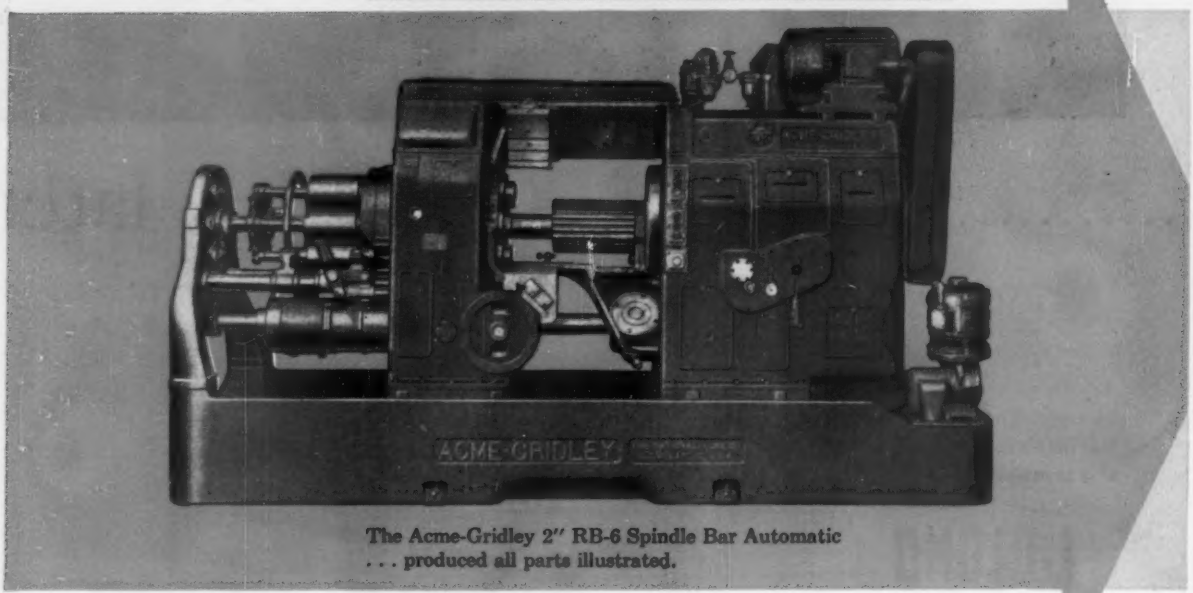
The R. K. LeBLOND
MACHINE TOOL COMPANY
Cincinnati 8, Ohio

ACME-GRIDLEYS CUT AVERAGE MACHINE TIME 75%

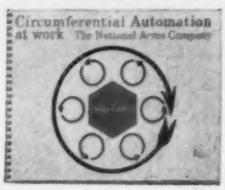
HELP HARDINGE BROTHERS HOLD THE LINE ON END PRODUCT PRICES

"There's no question about it . . . Acme-Gridley Bar Automatics are one of the reasons we haven't raised prices of our precision machines and attachments since 1956! And here's why" explains H. A. Lundy, Vice President of Hardinge Brothers, Inc., Elmira, New York, "when we need over 250 identical precision parts that can be grouped with other parts made from the same size bar, the job automatically goes on an Acme-Gridley. By switching jobs like those shown from conventional turret lathes, we reduce machine time an average 75% including setup time. With this kind of efficiency, it is economical to stockpile parts far beyond our immediate requirements, and take advantage of lower part costs to hold the line on selling price."

As Mr. Lundy says . . . there's no question about it. For short as well as long runs of identical precision parts, Acme-Gridleys are a sure way to cut production costs and increase earnings for years to come. Get in touch. We'd be happy to provide complete details.



The Acme-Gridley 2" RB-6 Spindle Bar Automatic . . . produced all parts illustrated.

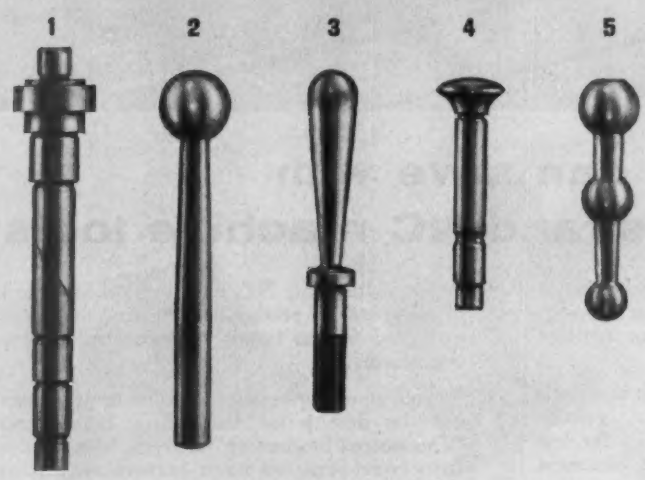


The number of *different* jobs that can be set up on any Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64-page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

HARDINGE PRODUCTION RECORDS ILLUSTRATE ACME-GRIDLEY SHORT RUN EFFICIENCY...

1 8620 Steel Clutch Cam. Run of 500 at 67 seconds per piece... 76.8% machine time reduction over previous method.
2 Rycase Steel Handle for Tailstock. Run of 850 at 59 seconds per piece...76.3% machine time reduction over previous method.
3 Rycase Steel Handle for Nut. Run of 1,100 at 61 seconds per piece . . . 72.2% machine time reduction over previous method.
4 Rycase Steel Spindle Lock Pin. Run of 500 at 59 seconds per piece... 76.3% machine time reduction over previous method.
5 C1117 (leaded) Steel Crank for Screw. Run of 2,000 at 44 seconds per piece... 89.2% machine time reduction over previous method. (All machine time reductions include setup time.)

The Hardinge HLV-H
Tool Room Lathe



HARDINGE
ELMIRA, N.Y.

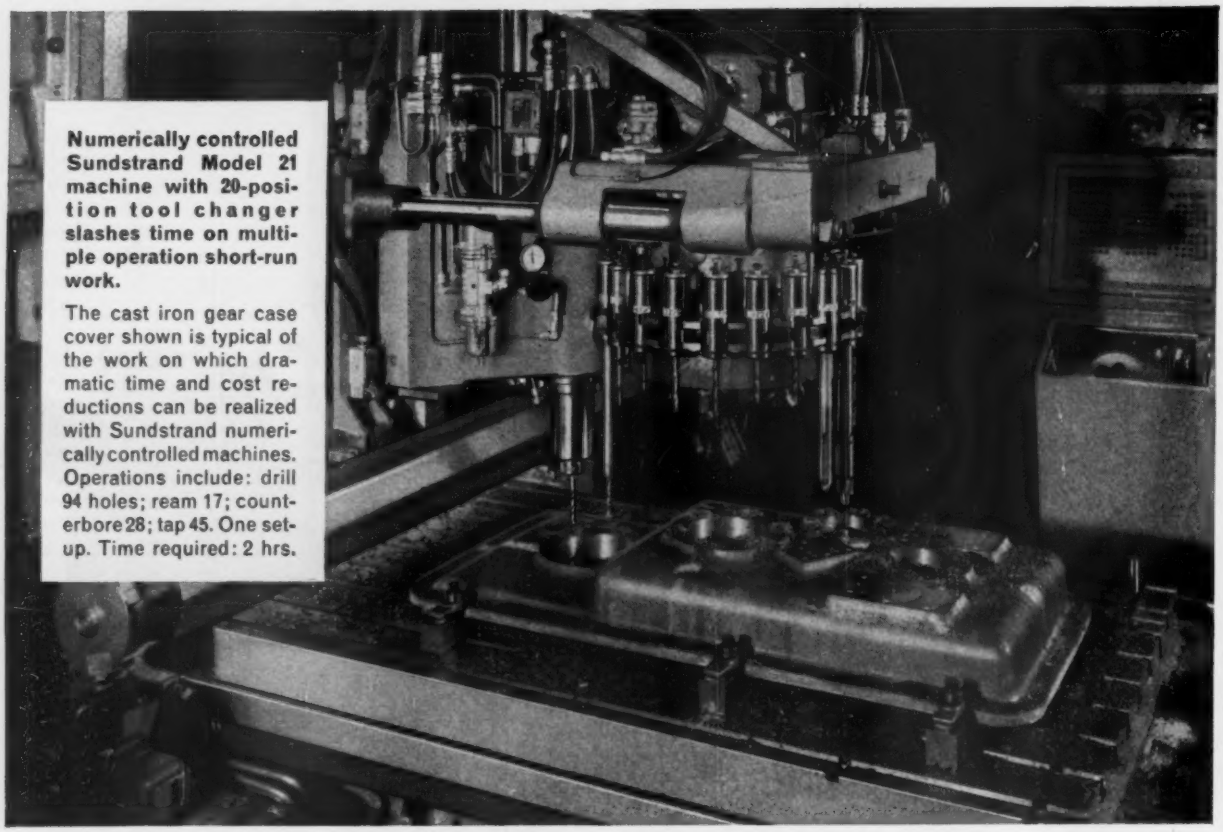
CIRCUMFERENTIAL AUTOMATION

National Acme

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

The National
Acme Company
171 E. 131st Street
Cleveland 8, Ohio

How fast can you machine



Numerically controlled Sundstrand Model 21 machine with 20-position tool changer slashes time on multiple operation short-run work.

The cast iron gear case cover shown is typical of the work on which dramatic time and cost reductions can be realized with Sundstrand numerically controlled machines. Operations include: drill 94 holes; ream 17; counterbore 28; tap 45. One setup. Time required: 2 hrs.

See what you can save with Sundstrand NC machine tools

The cost reduction potential of Sundstrand numerically controlled machines can be measured in terms of both direct *and* indirect savings.

Faster production comes from programed feeds and speeds . . . reduced cut and try . . . greater accuracy . . . faster positioning . . . far less non-productive machine time and increased machine utilization.

Increased machine versatility permits greater freedom in design and more frequent product improvement. Lead time often can be cut from weeks to hours. Scheduling, work routing, and time study are improved and simplified.

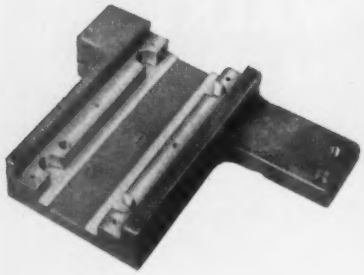
Workpiece handling and setup time almost always decrease with numerical control. Fewer machines and checking operations are required, freeing floor space and personnel for more productive work. Jigs often can be eliminated, and fixturing simplified.

With Sundstrand NC machines, the control of all phases of production affecting final cost is placed in the hands of management and engineering.

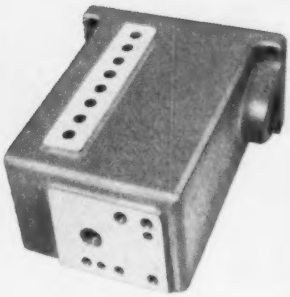
In your shop, the opportunities for such savings can be determined through a Sundstrand "Engineered Production" analysis, which takes into consideration such factors as initial investment, present and future work requirements, workhandling, floor-to-floor time, tooling requirements, and many others.

Write for Bulletin No. 132 describing the Sundstrand line of numerically controlled machine tools, typical applications and savings, and tooling designed for the machines.

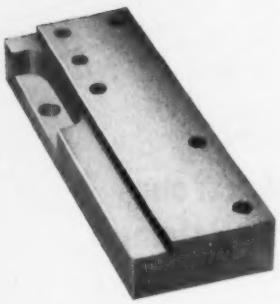
parts like these?



Aluminum indicator carriage — 9.5 minutes
Mill 4 steps and 4 pockets; drill 12 holes; tap 8; saw slot. One setup.

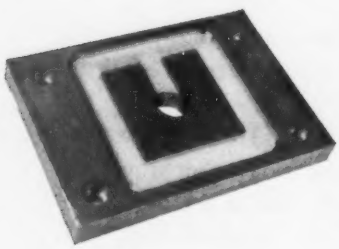


Cast iron switch box — 36 minutes
Drill 27 holes; tap 13; counterbore 4; ream 8; mill four surfaces and three pads. Three setups.



Steel support plate — 30 minutes
Drill 13 holes; tap 5; counterbore 6; mill step and pocket. Three setups.

Aluminum end spreader bracket — 12 minutes
Mill ends; mill 2 pads; ruff and finish keyway; drill and tap 8 holes. One setup.

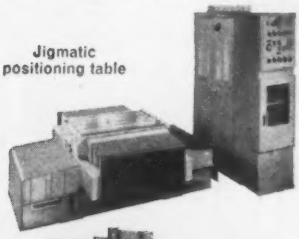


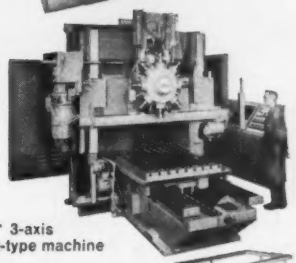
Steel test block — 3 minutes
Mill 1" wide channel .187" deep at 15 inches per minute feed. One setup.

3-1/2 hours — 19 tools perform over 260 drilling, chamfering, counterboring, tapping, reaming and slot milling operations in top and bottom of this part. Previous method — 17-1/2 hours.

Sundstrand Numerically Controlled Machines . . .

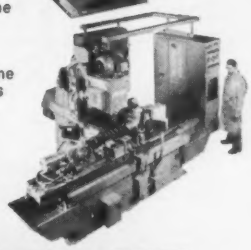
Jigmatic positioning table





3-axis turret-type machine

Crankshaft milling machine . . . and others

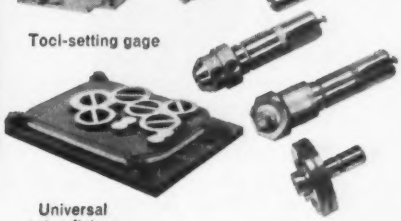


5-axis Omnimil

. . . and matching tooling for every requirement

Key-driven quick-change tools and toolholders for any Sundstrand NC machine or tool changer.

Tool-setting gage



Universal setup fixture

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • **Division of Sundstrand Corporation**

No Matter How Complex Your Problem Is In Magnetic Holding - *Walker* HAS THE "KNOW-HOW" TO SOLVE IT.

Walker engineers are continuously solving *new* holding problems for industry. The three-faced electromagnetic chuck above is only one example of the special designs created by Walker ingenuity and "knowhow". Whether you need any one of the complete line of standard magnetic chucks or a specially designed item, your best source is Walker.

Three Typical Walker Solutions to Unusual Problems

Top — A large three faced electro-magnetic chuck measuring 13½" x 22" x 158" built for the knife grinding industry.

Middle — A special rotary auxiliary plate with cylindrical magnetic raising blocks holds irregularly shaped parts for grinding with quick easy set-ups.

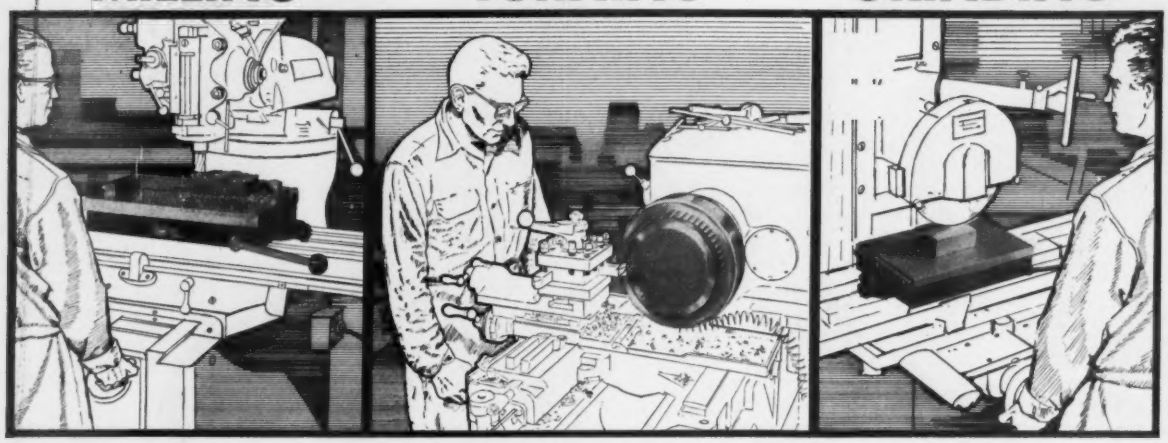
Bottom — A special saturable Reactor Control Demagnetizer for ball bearings.

O.S.Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks

MILLING **TURNING** **GRINDING**



WALKER CERAMAX CHUCKS

Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of *equal* strength keep cutting tools demagnetized.

NEW

"COLD" OPERATING ELECTROPERM CHUCKS

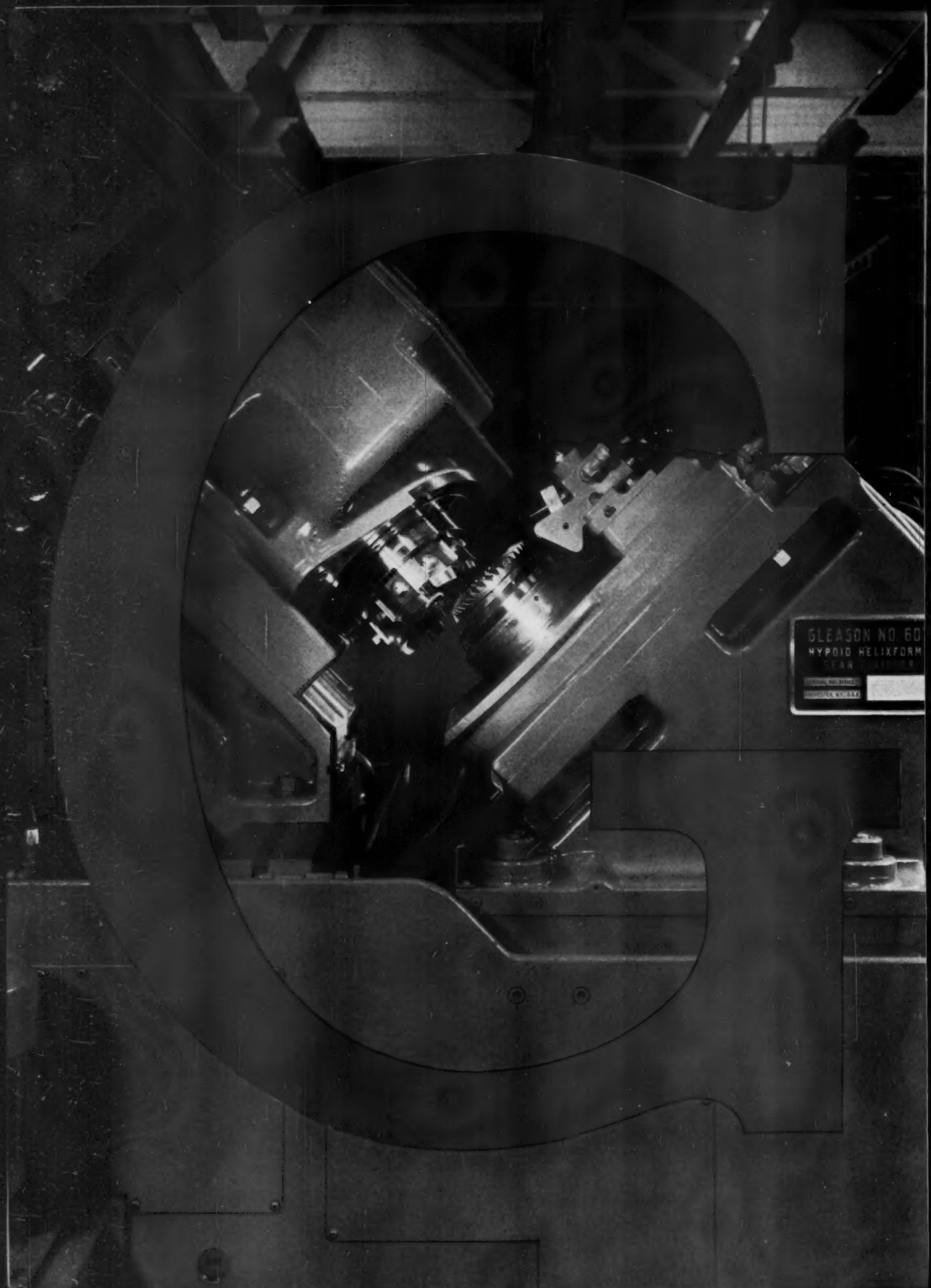
Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.

Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

O.S. Walker

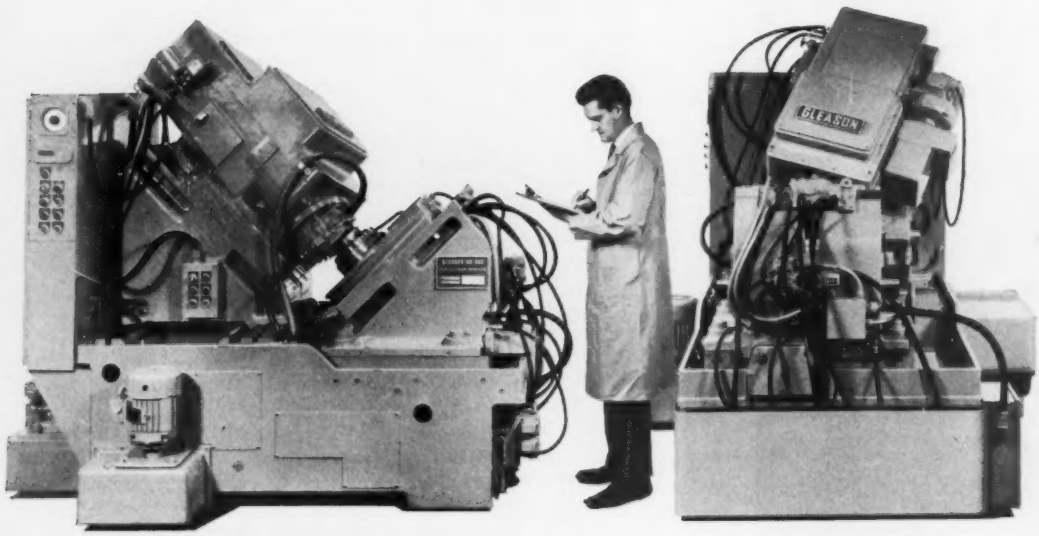
O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks


GLEASON NO. 60
HYPOID HELIXFORM

...PRODUCES QUIET, ACCURATE GEARS, UP TO 50% FASTER...AND SAVES FLOOR SPACE. These new Gleason "inclined-spindle" Hypoid Gear Cutting machines are primarily designed for faster, more accurate roughing and finishing of automotive main drive gears up to 10½" O.D. ■ Unique "inclined-spindle" design provides greater rigidity for precision cutting. ■ New type cutters, faster index and work clamp arrangements combine with automatic loaders to increase production up to 50%. ■ Yet, these new machines occupy 35% less floor space than previous machines. ■ Set-up and operation are simplified . . . only four summary settings with simple gage bars to relate work and cutter. Any number of machines can be set-up with the same gage bars to produce identical gears . . . no expensive set-up fixtures needed. ■ New magnetic chip removal and coolant systems assure constant forced flow of clean oil over the work . . . help prolong cutter life, eliminate periodic cleaning, and minimize coolant loss. ■ For information on these all-new machines write Gleason Works, 1000 University Avenue, Rochester 3, New York.

A BRAND NEW ANGLE IN GEAR CUTTING . . .



NEW GLEASON No. 606 Hypoid Gear Rougher

NEW GLEASON No. 607 Hypoid Helixform Gear Finisher

GLEASON

When the job calls for
MICRO-PRECISION
put it on a
Wade Variable Speed
HAND TURRET or
FINISHING LATHE...

- Turn to a √5 finish
- Turn round to 25 millionths
- Hold concentricity .0002" on 5 or 6 diameters
- Perform 7 distinct operations at one chucking
- 1 1/16" or 2 1/4" collet capacity
- One-second cycle with a standard motor through electric clutch drive
- Variable speed from 140 to 3500 RPM by push button control

NOW MANUFACTURED, SOLD AND SERVICED BY
Send today for full details — Dept. A91.
OVEL MFG. CO.
Benton Harbor, Michigan

LETTER from the PUBLISHER

It's Really Yours

This letter has appeared regularly in each issue for a little more than eight months. Its purpose is to tell you about the things we are doing to make AMERICAN MACHINIST/METALWORKING MANUFACTURING more useful to you. We have talked about the importance of reading a good business publication; how we edit the publication so you can get information easily and quickly; the advantages of receiving your copy at home where you have the time to concentrate on articles of value to you. We've also emphasized the importance of certain **technological breakthroughs** such as numerical (tape) control and have suggested where you could obtain complete information on this and other subjects important to you.

You like it . . .

Our every-issue reader survey (we've been conducting it for over 15 years) tells us you are interested in what we've been talking about in these letters. Since this letter is very much your letter just as AM/MM is very much **your** publication, I want to share with you some of the results of these surveys. Fifty-eight per cent of you (a little over 26,000) particularly liked the letter entitled "The Solution Is Simple (February 20, 1961); 39% found "You Have A Right To Insist" (April 3, 1961) interesting; you like "A Major Breakthrough" (March 6, 1961). It got a vote of 41%. Other scores ranged between 30% and 40%.

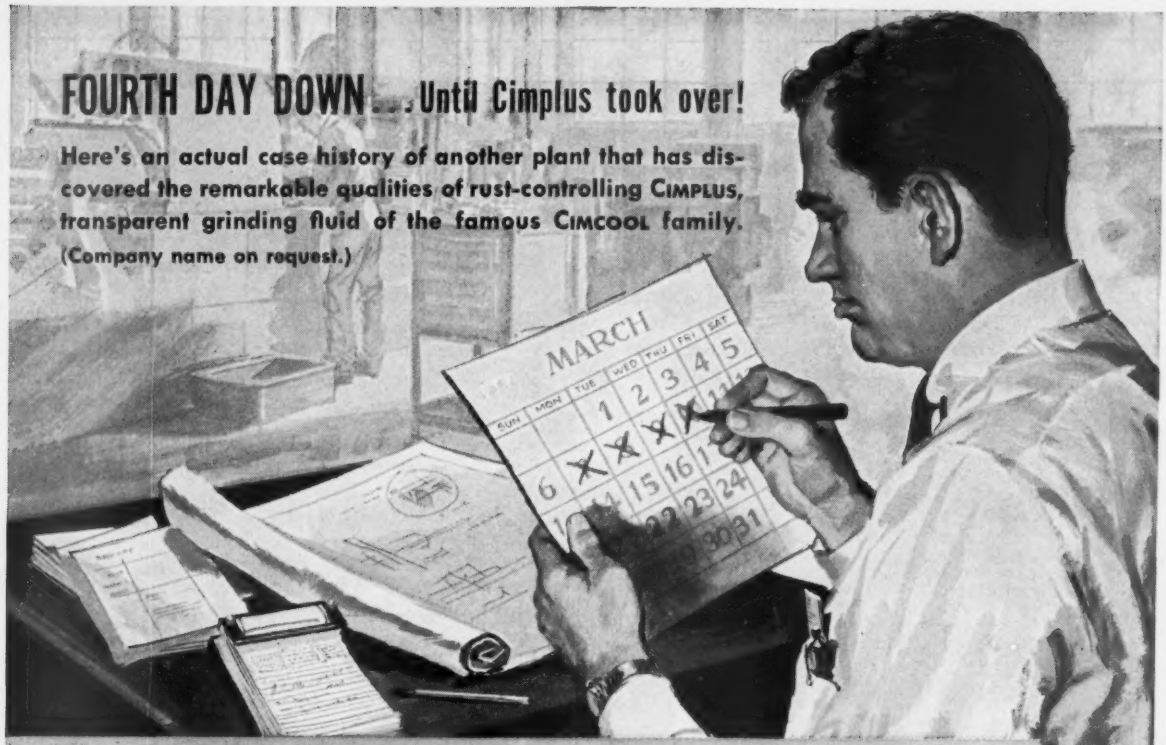
Tell us . . .

We want to be as interesting and useful to you as possible. This publisher's letter is just one way of drawing your attention to how we are going about this. We are interested in what **you** think, so tell us. Our every-issue survey helps in this connection, but if you have ideas or suggestions about articles you'd like to see, write us. And, of course, the finest endorsement you can give us is to buy our product. So, if you like what we are giving you, the next time you get that notice, renew your subscription promptly.

George Reppert

FOURTH DAY DOWN... Until Cimplus took over!

Here's an actual case history of another plant that has discovered the remarkable qualities of rust-controlling CIMPLUS, transparent grinding fluid of the famous CIMCOOL family. (Company name on request.)



FIELD SERVICE REPORT

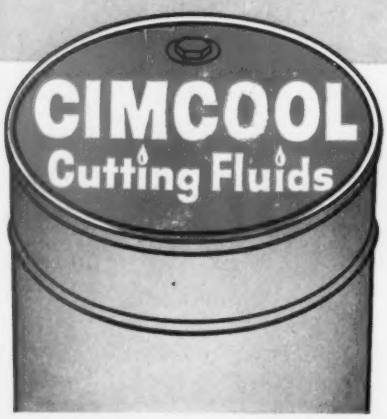
The job was grinding cast iron machine tool parts on three rotary surface grinders with an 1800 gallon central cutting fluid system.

The coolant they had been using had let the sludge cake up and clog up the lines and they had been shut down for four days. Then we installed Cimplus at 100 to 1 dilution and the problem was solved.

Since Cimplus took over, they've had no sludge trouble at all. The swarf and grit settles nicely for them, but it doesn't cake. They're also real pleased with the rust prevention on the cast iron parts that Cimplus gives them.

Kent Reece
N. Y. Office

Page 2



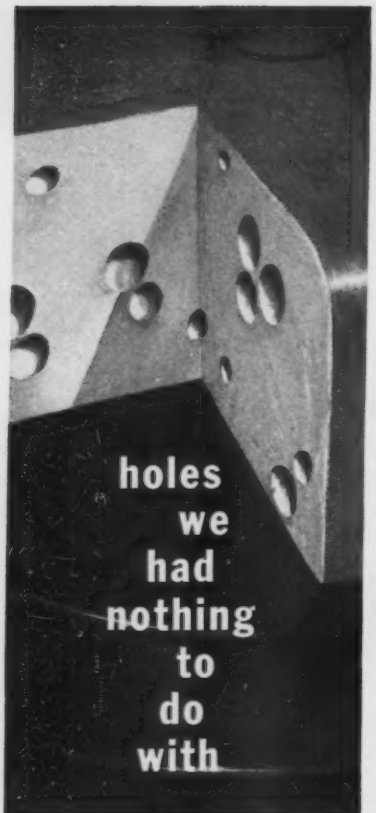
FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMCOOL S2 Concentrate — The pink fluid which covers 85% of all metal cutting jobs.
CIMPERIAL° — Newest in the famous, industry-proven line of CIMCOOL° Cutting Fluids.
CIMPLUS — The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, S5) — For every job requiring an oil-base cutting fluid.
ALSO — CIMCOOL Tapping Compound — CIMCOOL Bactericide — CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

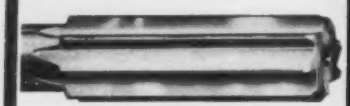
°Trade Marks Reg. U. S. Pat. Off.



Not these, of course. But holes that L&I reamers do have something to do with are precision, properly-sized holes in metal. Because there is such a complete line of L&I reamers, your selection is greater, allowing you to choose exactly the right reamer for your particular job requirements.

Your nearby L&I Distributor stocks a full line of reamers. Call him today for fastest service.

NEW! HLB ECONOMY STUB REAMER. The first economy reamer for automatic screw machines is fully described with sizes available in new 4 page brochure. For your FREE copy, see your distributor or write



L&I

LAVALLEE & IDE, INC.
"THE REAMER SPECIALISTS"
CHICOPEE, MASSACHUSETTS

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Fat Bars or More Bars

Dear Sirs:
Unless we're mistaken (and that's a distinct possibility), the three bottom histograms on p110 of W F Conroy's article, "Meet Mr. Sigma" (*AM/MM*—Aug 21 '61, p109) do *not* prove the point Mr Conroy tried to make. What he says is prefectly true, but the diagrams seem to "fudge" a bit.

The reason he gets differently shaped bell curves from the three diagrams is primarily that he has changed his abscissa (X-parameter, if you prefer the terminology currently in vogue).

Notice that the major difference is the "fatness" of each bar, which does *not* alter the distribution. This approach is the same as compressing a sine curve by a change of coordinates, then claiming you've changed the frequency.

Rather, a change of distribution —and therefore shape of bell curve—is the result of *more* bars of different heights, which may result from a more careful screening, smaller incremental deviations, or most likely different tolerances.

We suspect strongly that Mr Conroy fully knows this—judging from the merits of his article—but that his art department doesn't.

Lucien R Grief
Grief-Associates, Inc,
New York, NY

Reader Grief is correct; we should have caught this discrepancy but didn't—Ed.

How You Look At It

Dear Sirs:
When you say on your "Materials" page (*AM/MM*—Sept 4 '61, p89) that 99.88% lithium is only 0.04% less pure than 99.92% lithium, it doesn't sound like much.

Why not say that the 99.88% lithium has 50% more impurities or that the 99.92% lithium has 33% fewer impurities?

Paul F Ronnholm
East Hartford, Conn

It's all a matter of viewpoint. We were impressed with the fact that both the conventional commercial grades and the high-purity lithium are so close to 100%.

Reader Ronnholm is apparently

SHOPMATES

N. Jarvis

— MY MEN ARE TOOL MAKERS NOT MAGICIANS — YOU GUYS CHANGE THAT SLOT AND THE TOLERANCE ON THE DOVE TAIL — THEN WE'LL TALK ABOUT TIME —!
THEY'LL BRING 'EM BACK AS IS IN A COUPLE HOURS AND HE'LL SAY, "THAT'S BETTER!"
N. JARVIS

*use Airpower–not Manpower**

CUSHMAN

AIR OPERATED CHUCKS AND CYLINDERS

* Cushman Air Operated Chucks speed production and improve product quality, eliminate fatiguing hand wrenching, plus related rejects and accidents.

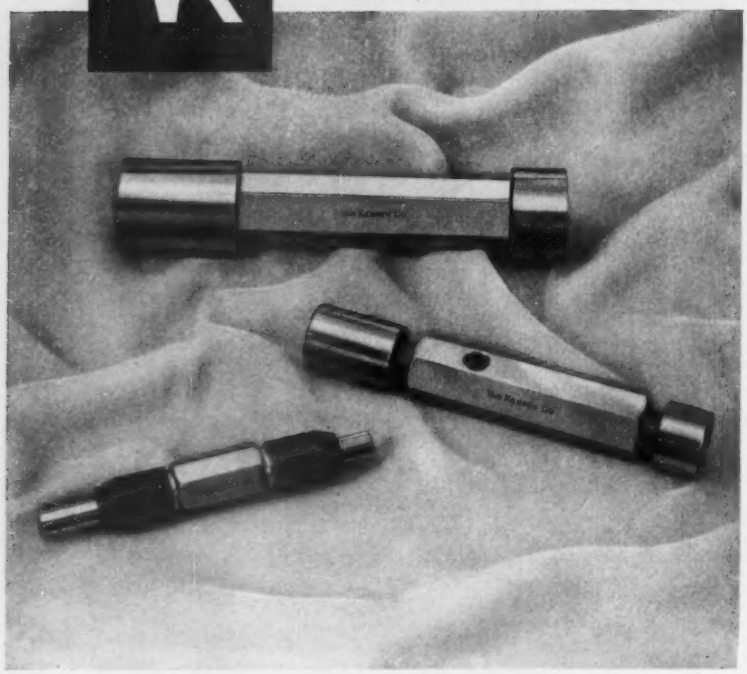
SOLD THROUGH
INDUSTRIAL DISTRIBUTORS

Cushman also manufactures manually operated chucks, power wrenches, and face plate jaws.

CIRCLE 306 READER SERVICE CARD

THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONNECTICUT

VK PLUG GAGES



WIRE TYPE
TAPERLOCK
TRILOCK

- **VAN KEUREN PLUG GAGES** are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.
- **VAN KEUREN PLUG GAGES** are available in Alloy Tool Steel, High Speed Steel, Tungsten Carbide or Chromium Plate.
- **VK GAGE ACCURACY** is based on precise measurements made in our constant temperature laboratory by comparison with masters calibrated at regular intervals by the National Bureau of Standards.

NEW! VK Handbook #36 Sect. II (Revised) ENGINEERING DATA is now available at $2.00 per copy.

THE VAN KEUREN CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS . . . rated the world's most accurate
Plug and Ring Gages • Plain and Thread Gages • Gage Blocks
Optical Flats and Light Wave Equipment • Precision Lapping Service and Parts • Measuring Wires
WA 6-1450

more impressed by the fact that such a large percentage of the remaining impurities have been removed from the commercial grades to produce the ultra-pure lithium—Ed.

Tankless Plating

Dear Sirs:
In your June 26 issue, there is an article that we would like to have more information on—"Tankless plating gets a new job" (*AM/MM* —June 26 '61, p86).

We would like to know where we can obtain the necessary material for plating and other information that would be of value in operation.

J L Van Allen
Missoula, Mont

Dear Sirs:
What is the street address . . .

J Williams
Chicago, Ill

Dear Sirs:
We are very interested in the article, "Tankless plating . . ." by Dr Cloyd A Snavely.

Can you assist us with Dr Snavely's address?

F W Senft
York, Pa

The equipment and solutions for the Dalic plating process are manufactured by Sifco Metachemical Inc, 935 East 63rd St, Cleveland 3, Ohio. The author of our article, Dr Snavely is general manager of Sifco—Ed.

AM/MM

"Call yourself an inspector? Nearly three o'clock and you've found no rejections!"

CALENDAR

Society of Automotive Engineers —National Aeronautic Meeting and Display, Oct 9-13, The Ambassador, Los Angeles, Calif.

American Standards Association — National Conference on Standards, Oct 10-12, Rice Hotel, Houston, Texas.

Magnesium Association — Annual Convention, Oct 16-18, Belmont Plaza Hotel, New York, N.Y.

National Safety Council — National Safety Congress, Oct 16-20, Chicago, Ill.

American Institute of Mining, Metallurgical & Petroleum Engineers — Metallurgical Society Fall Meeting, Oct 23-26, Pick-Fort Shelby Hotel, Detroit, Mich.

American Society for Metals — National Metal Exposition and Congress, Oct 23-27, Cobo Hall, Detroit, Mich.

Society for Nondestructive Testing — Annual Convention, Oct 23-27, Henrose Hotel, Detroit, Mich.

National Tool & Die Manufacturers Association — Annual Convention, Oct 25-29, Huntington-Sheraton Hotel, Pasadena, Calif.

American Gear Manufacturers Association — Semi-annual Meeting, Oct 29-Nov 1, Edgewater Beach Hotel, Chicago, Ill.

Industrial Management Society— Industrial Engineering and Management Clinic, Nov 1-2, Pick-Congress Hotel, Chicago, Ill.

National Electrical Manufacturers Association — Annual Meeting, Nov 16, Plaza Hotel, New York, NY.

American Society of Mechanical Engineers — Winter Annual Meeting, Nov 26-Dec 1, Statler Hilton Hotel, New York, NY.

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Statler Hilton Hotel, Washington, DC.

Society of Plastics Engineers — Annual Technical Conference, Jan 30-Feb 2, Penn-Sheraton Hotel, Pittsburgh, Pa

American Society for Metals — Golden Gate Metals Conference, Feb 15-17, Fairmont Hotel, San Francisco, Calif

At General Electric's Industry Control Department plant, Salem, Virginia, Di-Acro's adjustable stroke and fast die change has reduced overall production time 20%.
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It takes less than 15 seconds to pre-set the length of stroke for most efficient operation and maximum safety. The rapid, dual speed work cycle provides fast approach, slow work and fast return—or a stroke as slow as 6 operations per minute. It's easy to "inch" the ram or reverse it at any point in the stroke. Dangerous sheet whipping with resultant costly kinking can be virtually eliminated. This dependable 25 ton hydraulic press brake is available in 6 and 8 foot bed sizes.

Designed for high speed, economical forming and fabricating of small parts. The 12 Ton series uses standard press dies and is practical for short run production and sample work. Available with 3 or 4 foot bed.

A complete selection of press brake dies for bending, blanking, box forming, corrugating, curling, hemming, punching and flattening. Fits all standard press brakes.

Di-Acro Rol-Form Dies eliminate work marking of highly polished or painted materials. Saves time and reduces die costs—one die does the job of many.

Consult the Yellow Pages of your telephone book under Machinery—Machine Tools for the name of your nearest Di-Acro distributor or write us.

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- ☐ Standard Press Brake Dies
- ☐ 12 Ton Hydraulic Press Brake
- ☐ Rol-Form Dies

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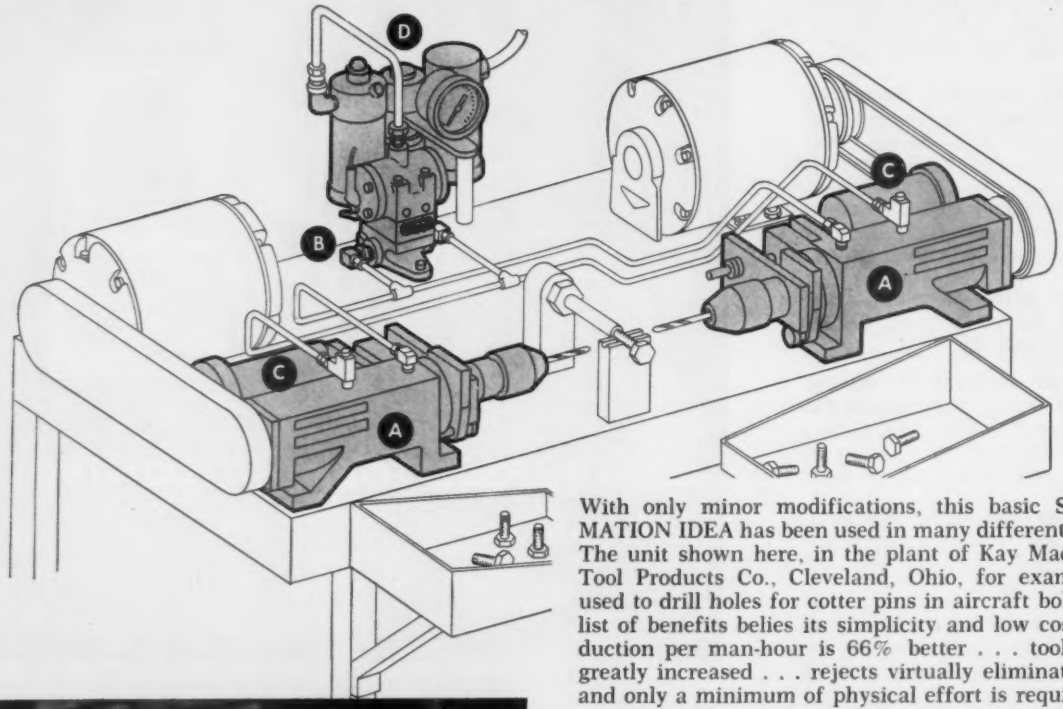


As shown in the photo above and "keyed" in the drawing, this shop-built drilling machine consists essentially of two low-cost, air-operated Bellows-Locke Model 22A Drill Units (A), a Bellows Electroaire® operating control valve (B), two Bellows Hydro-Checks® which provide smooth precision operation (C) and a Bellows Lubri-Air® Control Unit which cleans, regulates and lubricates the air supply (D). Not visible is the foot-operated control pedal.

697C-3

With only minor modifications, this basic SPOT-A-MATION IDEA has been used in many different plants. The unit shown here, in the plant of Kay Machine & Tool Products Co., Cleveland, Ohio, for example, is used to drill holes for cotter pins in aircraft bolts. The list of benefits belies its simplicity and low cost: production per man-hour is 66% better . . . tool life is greatly increased . . . rejects virtually eliminated . . . and only a minimum of physical effort is required for what formerly was a very fatiguing operation.

The machine is built around two compact interlocked Bellows-Locke Model 22A Drill Units — air operated, hydraulically controlled — mounted horizontally in opposed positions. Automatic feeding, positioning and ejection could be incorporated easily by the addition of other Bellows "Controlled-Air-Power" Devices. This SPOT-A-MATION IDEA can be readily adapted to perform a wide range of other operations, such as punching, forming, riveting, crimping, etc., by using such other Bellows work units as The Bellows Air Motor® in place of the Drill units.

This machine is typical of the ways cost-conscious men the world over are using Bellows "Controlled-Air-Power" Devices to secure faster, better, lower-cost production. Opportunities exist in your plant, too. Why not investigate — *today!*

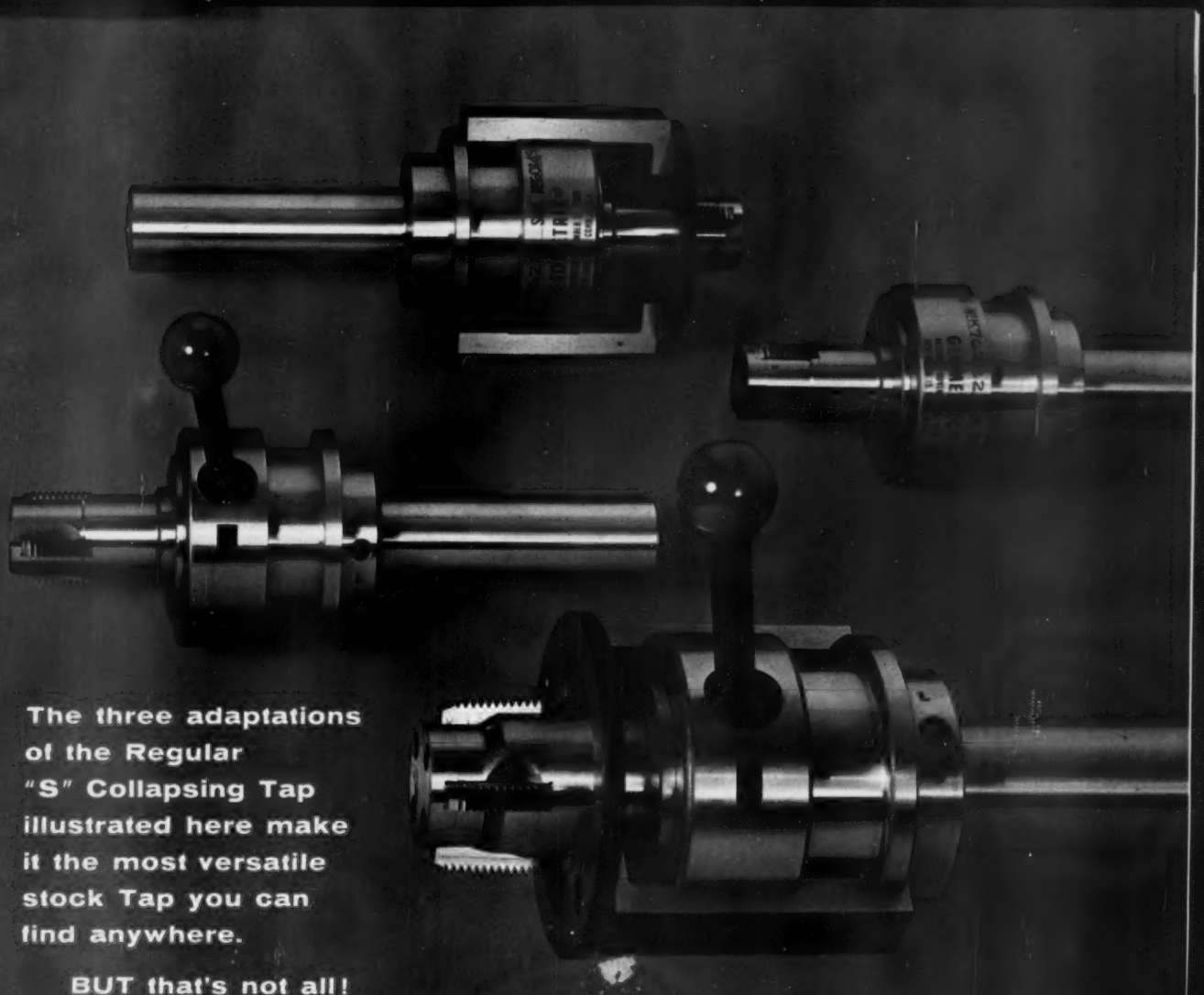
THIS "SPOT-A-MATION IDEA" FILE IS YOURS ON REQUEST

Contains installation data, wiring diagrams and equipment lists for the "Spot-A-Mation" idea sketched above, as well as for scores of similar ideas you can use. Write Dept. AM-1061, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

AKRON 9, OHIO

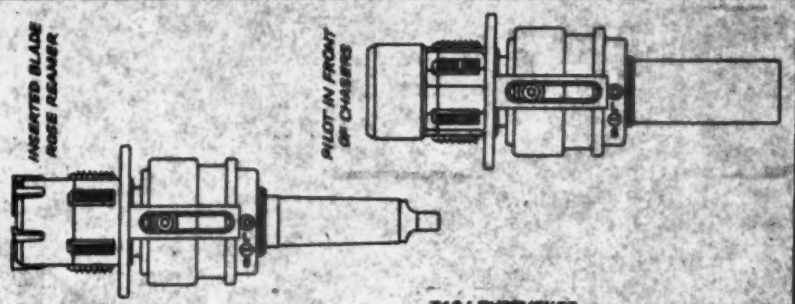
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

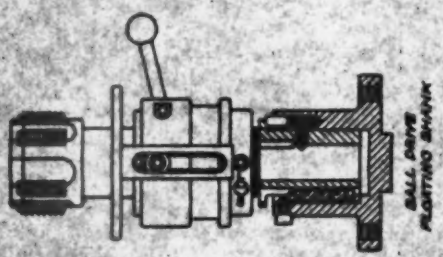


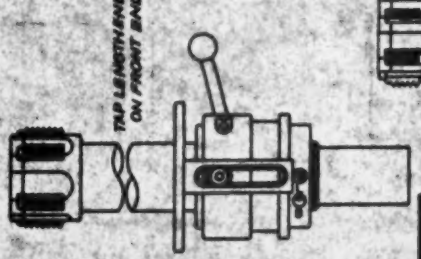
The three adaptations of the Regular "S" Collapsing Tap illustrated here make it the most versatile stock Tap you can find anywhere.

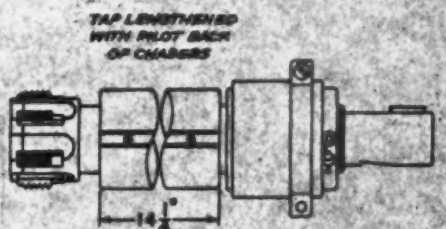
BUT that's not all!

HERE ARE A FEW SKETCHES SHOWING SOME SPECIAL ADAPTATIONS WHICH HAVE BEEN FURNISHED FROM THE BASIC "S" DESIGN. WE HAVE HUNDREDS MORE IN OUR FILES WE'D LIKE TO SHOW YOU









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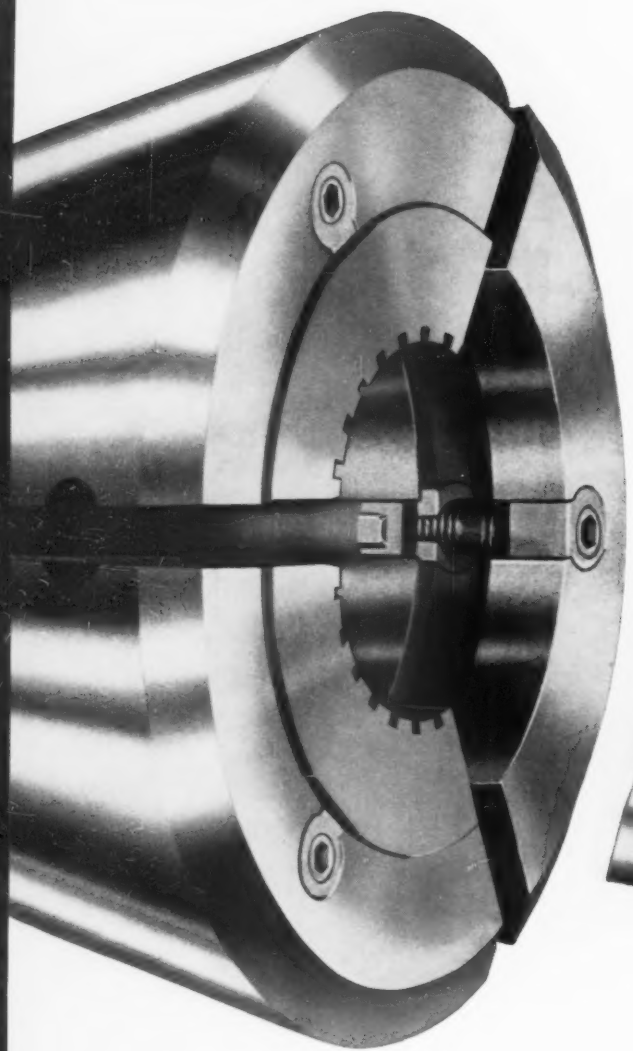

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SPOT NEWS...

- **Cast iron combining high tensile strength and ductility** has been produced by Sibley Machine & Foundry Corp (South Bend, Ind) in a heavy-duty Tagliaferri low-frequency induction forehearth. First products made with the new material were valve-body castings for Bendix power brakes. The furnace can also refine aluminum, steel, and other metals.

- **Major space contracts running to billions of dollars will be let** in the next few months. NASA opens bids on October 16 for production of the engine that will serve as the first stage for the Saturn C-1 booster (See p69). By the end of the year NASA is expected to select a prime contractor for the Apollo space capsule that will carry three men to the moon by 1967-1969.

- **Binary alloys of columbium are harder than pure columbium,** especially at high temperatures, report Russian scientists in the journal *Atomnaya Energija*. The increase in hardness is even more pronounced in systems of more than two components. Compared with pure columbium, binary alloys are 1.5 times as hard at 20 C, 5 times at 800 C, 10.8 times at 1000 C. Six-component alloys (Cb, Mo, Zr, Si, Al, C) are 2.96 times as hard at 20 C, 19.3 times at 1000 C.

- **Small and medium-size metalworking concerns will be able to compete** on a cost, quality, and performance basis with larger companies under a cooperative job plan set up by Manufacturing & Machining Services Corp, Hillside, NJ. Member companies will share in the efforts of an established sales organization which will solicit bidding opportunities for member shops on manufacturers' sub-contracted jobs and government work. Plan now has 155 members, hopes to have 2500 by the end of its first year.

- **Insertion of a nylon tube into stock tube of an automatic cuts noise** by more than 50%, claims a British concern that tried it on 40 machines. Extruded tubing, available with any specified wall thickness in sizes up to 2 in. OD, was developed by Uni-Tubes Ltd, Knightsbridge, London SW 7, England.

- **Bank loans to metal and metal-products producers** "have been most disappointing, says a New York bank that cites "over-capacity" as the reason. A midwestern bank, also noting the sluggish loan market, attributes this to a reduced rate of capital spending, more equity financing, and an improvement in cash flow and profits for many companies.

- **Welded aluminum cans will be produced at three time conventional rate** on machines that Reynolds Metals Co will purchase, use, and lease to can-makers, under terms of an agreement between Reynolds and New Rochelle (NY) Thermatool Corp, developer of the machinery. Machine forms tubular can stock from long coils of metal and produces a strong side seam by high-frequency resistance welding (*AM/MM*—Mar 21 '60, p114). See page 2 for another development in high-speed can-making.

- **Japanese machine tool exports will be promoted** by the new government-subsidize Machine Tool Export Association. It will buy about 120 machines from member companies and loan them to plants throughout US and Europe, in hopes of developing future markets for Japanese machine tools.

- **Wages are outstripping productivity in West Germany,** and if the trend continues, warns the Industry Institute in Cologne, prices are sure to go up. Hourly wages in May were 10.2% higher than in the same period a year ago, while productivity in the first half of 1961 was only 5% higher than in the corresponding period of 1960.

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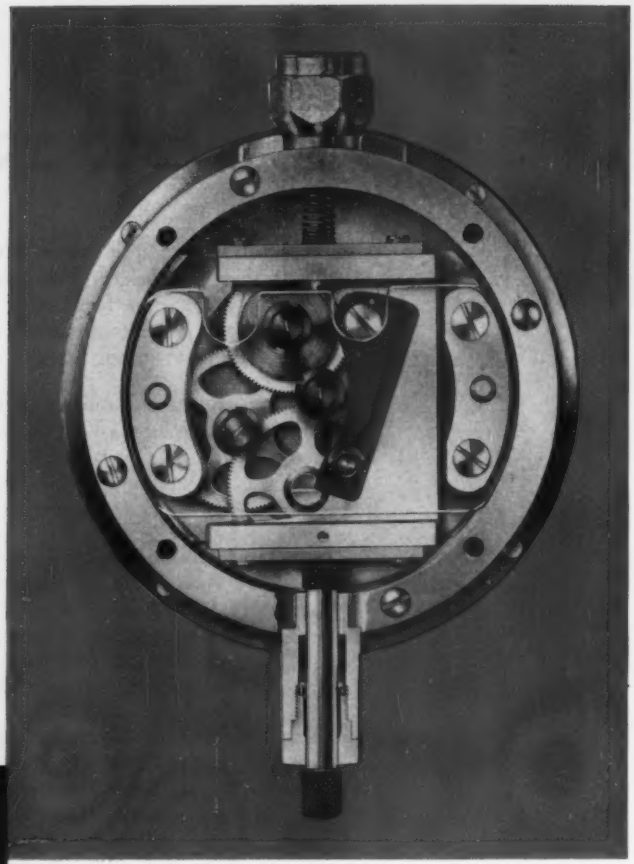
AT A FRACTION OF THE COST!



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- a design which provides high magnification (.000050" grads) over the FULL AGD range with two to four times the calibration and repeat accuracy of conventional indicators.
- a design which provides repetitive accuracy to within FIVE MILLIONTHS of an inch!
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- a design which provides POSITIVE PROTECTION for these exceptional accuracies against shock . . . against wear!
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WASHINGTON...

Tax credit heads the list . . .

The first order of business for the Ways and Means Committee next February will be the 8% across-the-board tax credit on purchases of equipment (but not plant).

You can get an analysis of the measure that the Committee has drafted. It includes a description of how the credit would work, new rules on the sale of depreciable property and on overseas earnings. Write the Joint Committee on Internal Revenue Taxation, New House Office Building, Washington 25, DC.

As a result of the resistance to its tax proposals this year, Treasury strategy on tax reform has changed. Earlier, Secretary Dillon had promised a wide-ranging reform bill sometime early next year.

Now, however, this will be delayed. Officials say it won't be submitted until mid-1962. The administration wants to concentrate on pushing through the House and Senate the bill now in the Ways and Means Committee.

Delay of depreciation reform?

One side effect of this may be a delay in the release of the Treasury's long-awaited study of depreciation practices, and its recommendations for bringing depreciation allowances into line with business practice.

Treasury officials have been trying to keep down any moves to substitute the popular liberalization of depreciation allowances for the relatively unpopular tax credit. One way to fend off any such prospect is to delay making the depreciation report public until after the tax credit is either passed or permanently killed.

Labor outlook . . .

The auto industry labor agreements hold the seeds for a new labor bargaining offensive. Walter Reuther's United Auto Workers signalled the start with the new contract gimmick providing extra pay for short work weeks. The United Steelworkers and other industrial unions, worried about job-trimming automation, are likely to aim for the same goals. Steel bargaining, the next big round, starts in mid-1962.

Reuther's breakthrough is this: Auto makers will pay for unworked hours under 40 to fill out employees' paychecks. Where the industry schedules a week under 40 hours, workers receive 65% of the take-home pay for hours not worked up to the 40 hour limit. In unscheduled short work weeks, the companies pay half of the going wage for the unworked hours.

This is a big leg up on the union goal of 52-weeks-a-year paychecks for industrial workers whose fortunes have shifted with the tides of industrial production. In broad terms, they are aiming for the same job security for the blue-collar force that's now provided for office employees. The UAW contracts are just the start.

New producer sought for M-113 . . .

The Army plans a massive expansion in production of M-113 armored personnel carriers to mechanize its infantry divisions and to accelerate modernization of its armored divisions. FMC Corp, San Jose, Calif, which developed the 9-ton, air-transportable vehicle, is now the sole producer. A new production source will be sought for the expanded output.

Under the new plan FMC will be awarded a "minimum add-on contract" to its current $40.6 million order awarded this spring. This will meet what the Army describes as "urgent requirements for expedited delivery."

In addition, the Army will award two new large-quantity production orders to contractors at "two dispersed locations." Competitive negotiations will begin shortly for these contracts, and FMC will be eligible to bid.

Background on M-113 orders . .

Earlier this year, soon after the current FMC contract was awarded, the Army suspended payment of funds for a month while the GAO investigated the way the contract was placed. The inquiry was stimulated by Senator Kefauver, who wanted to know why the order didn't go to the Wheland Co of Chattanooga, Tenn, a labor-surplus area. Kefauver said that Wheland's bid was only $7000 over FMC's.

Pentagon policy, however, is to give preference to firms in labor-surplus areas only when they can match low bids of other producers.

More new military vehicles . . .

The Army will shortly award the first production contracts for three new armored vehicles—the T-114 armored reconnaissance carrier, the T-195E1 self-propelled light howitzer, and the T-196E1 self-propelled medium howitzer. Contracts will go to the Cadillac Division of General Motors, which developed the vehicles. They will be made at the Cleveland Ordnance plant.

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the more durable, ductile, flexible phosphor bronze—at no extra cost

Here is one of the most versatile of phosphor bronzes. The superfine-grain structure of Duraflex provides a considerable improvement in fatigue life over regular phosphor bronze. Now you can obtain higher endurance limits with greater formability. It's ductile. It's resilient. It's corrosion-resistant!

This new, higher quality Anaconda phosphor bronze is now available in several standard phosphor bronze alloys—in strip metal up to 0.062″ thick and up to 14″ wide in all standard tempers, and in wire up to 5/16″ diameter. Duraflex strip is also available in long rolls.

Within the capabilities of size and alloy composition, Duraflex strip and wire can be applied to the innumerable uses for which conventional phosphor bronzes are employed, and in most instances provide longer and more efficient service. *Yet Duraflex sells for the same price as regular phosphor bronze in the same alloys and forms.*

Publication B-38 tells the story. Write for your copy—or for any assistance from our Metallurgical Dept. in selecting the proper alloys for your metalworking projects. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-1148

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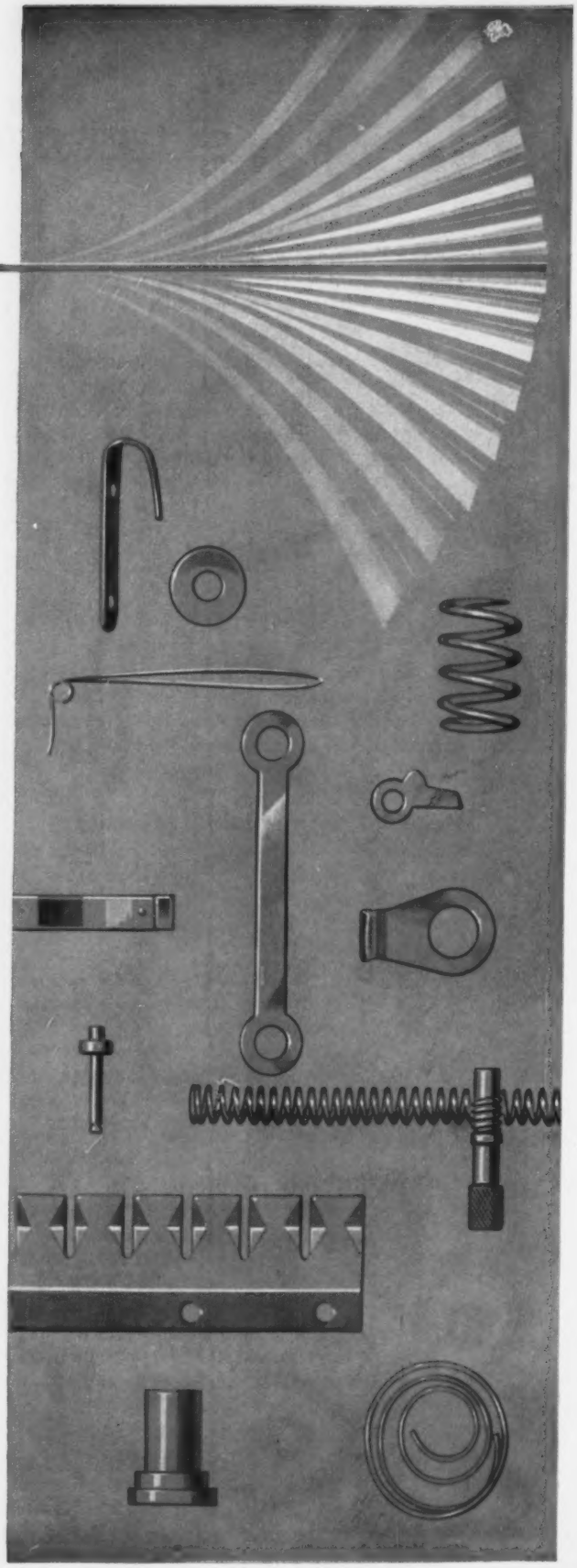

DETROIT...

Imports in a dogfight . . .

Detroit forecasters, such as divisional vice presidents talking at their new-car introductions, have been guessing at 400,000 imported cars for the coming year—either model year or calendar year, whichever you please. This is down from the 600,000 peak of '59, from the under-500,000 of '60, and also from the probable figure for '61 of just under 450,000 cars.

If this is fairly accurate (and it probably is), and if Volkswagen's hopes for a US volume of at least 200,000 are realized (and they probably will be), then there remains for all the other importers 200,000 cars or thereabouts. Of course you have to subtract some 60,000 to 75,000 for sports cars, which are a pretty solid market nowadays. Then take away about 60,000 for second-running Renault, which is their hoped-for figure. That leaves around 75,000 possible sales for all the remaining importers, which spreads them a bit thin.

General Motors has decided to stop importing its German Opel and its British Vauxhall (though service and repair parts will continue), and Ford stopped bringing in its German Taunus some time ago. This leaves the British Fords, mainly two-door Anglias, which will be continued as long as the volume is "practical"; plus the Simca 5, a high-horsepower version of Chrysler's import. Of course the Rambler Metropolitan just goes on and on at a moderate volume, a bit under 1000 per month.

One reason for cutting off imports, as far as US car builders are concerned, is that dealers haven't pushed them because they had US compacts to sell.

Cardinal capers . . .

The question in Dearborn must be, "what's going to happen to VW?" If the imported-car market is on a real downslide (in spite of their optimistic predictions lately), can VW really boost its US sales some 10% this coming year? If so, can a new entry—the Cardinal, with similar dimensions and front-wheel drive—make a reasonable dent in the market?

Ford's Cardinal program is still on, though much of the tooling was brought back from Germany because of slow delivery. But even a multi-million-dollar program can be cancelled at the last minute if the market doesn't look right. If VW sales slip instead of rise in the coming six months, will this be sufficient indication for Ford that the small-car market has reached a limit, and that the trend is back to the more moderate size?

To make the Cardinal effort worthwhile, Ford would have to dig deep into VW sales, practically supplant the Renault, and cut a wide swath through sales of all the other small sedans being imported.

Production figures . . .

General Motors hit a low point in production in mid-September and just after. However, by early September all its divisions had assembled and shipped a generous number of cars for dealer display. How much this production stumble due to the strike will cost GM in total sales for the year is open to question. Best guess now: not much, but a little.

Ford has been building up to full assembly capacity through September. Interesting point is that Falcon assemblies in Mid-September were almost as high as Ford totals—13,600 in the week of Sep 16 for Falcon vs 15,000 for the full-size Ford.

Plymouth and Dodge, in the same week, were each making assemblies at around 4000 per week, which is not quite up to their average rate before model changeover. Studebaker has been building almost 2000 cars per week, which is about 1/3 more than before their early shutdown for changeover.

Technical notes . . .

The reason Buick has been offering only one V8 engine size (401 cu in.) in its larger car is that the production space formerly required for its smaller engine option is now taken over for production of the 198-cu-in. V6 cast-iron engine for the less expensive Buick Special models. This makes Buick one of the most versatile engine-block producers, for they still turn out aluminum V8 blocks for Olds and Pontiac, as well as for themselves, on a third engine-machining line.

Ford indicates there is a practical limit to the size of car adaptable to unit-body (no heavy chassis) construction, and the break comes between the Fairlane (115.5-in. wheelbase, 197 in. overall) and the Galaxie (119-in. wheelbase, 209 in. overall).

Plymouth and Dodge evidently do not agree, because their '62 models (116-in. wheelbase, 202 in. overall) are now completely unitized; that is, no stub frame in front of the firewall for engine support.

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And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

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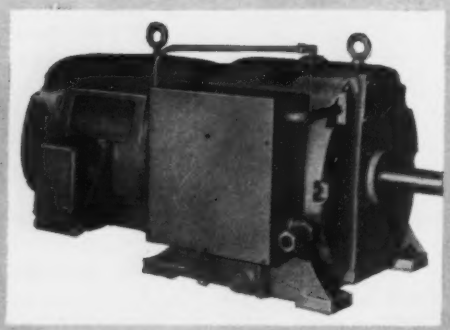

WATER COOLED, 25 to 150 HP

AIR COOLED, 1 to 5 HP

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AIRCRAFT and MISSILES... TRENDS

To spend, or not to spend . . .

Odds are that Defense Secretary McNamara will make a major policy reversal on Boeing B-52 bomber production in the near future. Up to now, he has resisted Air Force pleas to continue B-52 output beyond next year, when current schedules will be phased out.

McNamara has adamantly said that he doesn't want to spend the $525 million Congress tacked on to the fiscal 1962 Air Force budget for procurement of at least 45 B-52 bombers—enough for a fifteenth Strategic Air Command bomber wing.

Now he's changing his mind. He says the matter is "under study" once more and that in view of the "overwhelming" Congressional vote in favor of continued manned bomber production, it "is incumbent upon us to review the facts again."

Actually, the extra bomber money could also be spent to buy additional B-58s, but Air Force generals reportedly prefer the B-52.

Extra funds for B-70, Dyna-Soar . . .

Secretary McNamara is also reviewing the possibility of spending the extra money Congress appropriated for the North American B-70 and Boeing Dyna-Soar development projects. Here again he is being forced by political pressures to reconsider his original positions.

For the B-70 mach-3 bomber, Congress added $180 million to the $200 million sought by the Defense Department. The extra money would be used to accelerate work on the prototypes now under way and to reinstate some of the sub-system development work cancelled earlier in the year.

Congress increased the Dyna-Soar appropriation by $86 million. The Kennedy administration had previously boosted Eisenhower's budget for Dyna-Soar from $70 million to $100 million.

No change for Nike Zeus . . .

The Secretary is also under increasing pressure to accelerate development work on the Army's Nike Zeus. The talk in Washington is that research on an anti-ICBM system figures prominently in the resumption of Soviet nuclear tests. There are fears that the Soviets may have made a technological breakthrough on development of a anti-missile missile.

But so far, McNamara says, "nothing has given us the basis for changing our plans on the Nike Zeus." By July 1962 the Nike Zeus will have cost $1.2 billion. The current year's budget calls for expenditures of about $200 million.

This is the first time in about three years that Congress failed to add money to the defense appropriation to begin production of long-lead-time components in the Zeus system.

Allison gets Minuteman contract . . .

The Allison Division of General Motors has been awarded a $10,935,000 contract by Thiokol Chemical Corp for production of first-stage rocket engine cases for the Air Force's Minuteman intercontinental ballistic missile.

The production contract came as the climax to more than two years of development work. During this period Allison developed, built, and shipped a substantial number of prototype cases which were used in static and silo firing tests.

In all these tests the Allison-built cases established a 100% reliability records. For the full story of how Allison built these rocket cases, see *AM/MM*—Aug 21 '61, p95.

Saturn booster awards due soon . . .

Contracts to build and test two Saturn booster configurations will be awarded to two contractors by NASA before the end of the year.

Thirty-seven prospective bidders for the S-I booster stage (composed of eight engines) met last week in New Orleans; bidders for the S-IB stage (a cluster of two 1.5-million-pound-thrust engines) will meet sometime this month.

Both boosters will be built at the government-owned plant at Michoud, La. The plant will be operated by the winning contractor, under the executive management of Marshall Space Flight Center.

NASA space center in Houston . . .

Space agency officials picked a 1000-acre site in Houston, Texas, for a $60-million laboratory to serve as a command center for manned flights to the moon and the planets. The site was made available by Rice University. NASA says the center will be used to train crews and develop space craft. The United States hopes to have a man on the moon by 1970.

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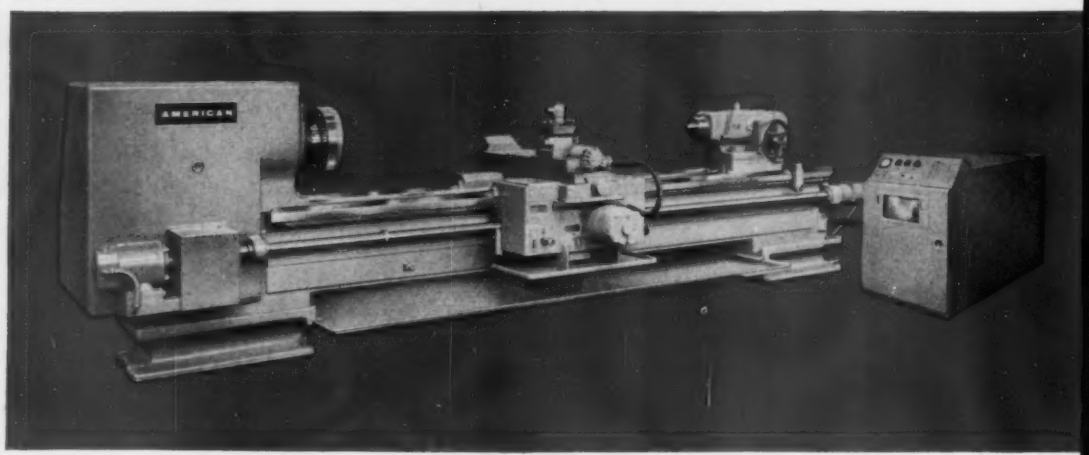

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CIRCLE 315 READER SERVICE CARD

MACHINE TOOLS...

NMTBA speaks out on Walsh-Healey

The public hearing to provide a record on which Secretary of Labor Arthur J Goldberg will presumably base his determination of a prevailing minimum wage for the machine tool industry under the Walsh-Healy act has been concluded. Parties now have until October 18 to file supporting briefs.

Under the Walsh-Healey Act companies that do business with the federal government in contracts involving more than $10,000 are subject to the minimum wage scale prevailing in their industry, as determined by the Secretary of Labor.

Grayson M Stickell, president of Landis Machine Co and chairman of the NMTBA's Walsh-Healey Act committee, says that the official record of the hearing shows many failures on the part of the Labor Department to consider relevant facts; that the Department's 1960 survey of the industry contained many errors; that the survey is outdated; and that the origin of the definition of "covered employees" used was lost in antiquity, as admitted by a government witness.

Industry testimony and cross-examination brought out the following factors:

- **The seriously depressed condition** of the machine tool industry and the adverse impact which a minimum wage would have on the wage structure.
- **Failure of the government survey** to cover all establishments capable of fulfilling government machine tool contracts.
- **Failure of the government survey** to include many low-wage or salaried production-connected employees who would be covered under the act, thus artificially increasing reported minimums by as much as 75¢ an hour.
- **Failure of the government survey** to reflect the lower wages paid apprentices who will not be exempted from the minimum wage once determined.
- **Numerous errors of omission and inclusion** of government contracts in government exhibits purporting to show nationwide competition for contracts as a basis for fixing a single nationwide minimum wage.

NMTBA's recommendations . . .

The Association's recommendations to the Secretary include:

- **That the Association's more recent survey** (a year later than the BLS survey), based on a correct definition of a "covered employee," be used as a basis for determination.
- **That the lowest prevailing wage rates** in the industry be considered the most representative of the prevailing minimum—especially for an industry with declining employment.
- **That if the Secretary rejected such rates,** the prevailing minimum be fixed at a point between $1.39 and $1.49.
- **That minimum wage determinations** should be made on a regional basis consistent with Census practice and pursuant to a resurvey.

Fringe benefits to be included? . . .

On the final day of hearings, the AFL-CIO requested that the term "prevailing minimum wage" be interpreted to include fringe benefits.

Specifically, it recommends that the current prevailing minimum wage be figured this way: As of April 15, 1960, $1.80 per hour, plus an adjustment of 13¢ per hour to update this figure, plus a ceiling allowance of 11¢ per hour for paid leave and 11¢ per hour for welfare plans—for a total minimum of $2.15 an hour.

Outlook for surplus tool plan . . .

The outlook for the administration plan to ship surplus government-owned machine tools and other capital goods to underdeveloped nations under the foreign aid program has brightened. The Senate has restored much of the foreign aid money that the House has slashed.

Plan is to use $5 million in foreign aid funds to buy this surplus equipment from government agencies and establish a pool of surplus capital equipment. This would be financed by a revolving fund.

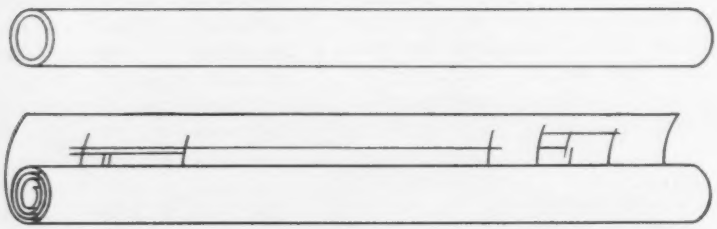
Gisholt to manufacture in Italy . . .

Gisholt Machine Co, Madison, Wis, has set up Gisholt Italia SpA in collaboration with some of the principals of an Italian firm to make some models of Gisholt Superfinishing and dynamic balancing machines.

Production will be on a very limited basis, and principally for the Italian market. The entire operation is "exploratory," says Gisholt, in that its outcome will determine, to some extent at least, what Gisholt will do in this field.

The machines will be made on a contract basis in an existing plant near Milan. There is no plan at this time for Gisholt Italia to erect or purchase a plant for its operations.

What's so difficult about matching stainless tubing to design ideas?



Nothing, when you share the problem of matching with a B&W tube specialist or a Steel Service Center representative handling B&W stainless tubular products.

With engineering know-how, and a full range of B&W stainless tubing behind him, he can take the million or so possible combinations of stainless grades, tube types, heat treatments, mechanical properties, physical properties, tube sizes and tube costs and help you come up with the one stainless tube that best meets your design requirements.

Why not work with a B&W tube specialist and B&W *Job-Matched* tubing on your next set of stainless tube specifications? You'll find it makes things easier.

The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

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TRENDS

MATERIALS...

Hi-temp stainless . . .

Basically steel but containing less nickel than most stainless alloys, a new alloy called SR is said to maintain its strength up to 1600F. Developed primarily for the chemical industry by the Kolcast division of Thompson-Ramo-Wooldridge, Inc, Minerva, Ohio, the new alloy contains 5 to 6% molybdenum and an equal quantity of copper, to improve its corrosion resistance. It contains no cobalt, columbium, titanium, or zirconium.

Stress-to-rupture properties of SR are said to exceed those of stainless and to approach the characteristics of superalloys. As cast, the alloy has a tensile strength of 120,000 psi. Yield strength ranges up to 105,000 psi. In tests the alloy has shown excellent corrosion resistance to sulfuric acid, sea water, most other acids, and a variety of corrosive materials.

Exact composition can be varied to suit specific applications. SR is available in bar, sheet, strip, and in castings. Compared with most stainless steels in its application range, SR is relatively easy to machine.

Alloys withstand 2500F . . .

Retaining useful strength at temperatures above 2500F, two new columbium alloys are available at the DuPont Metals Center in Baltimore. Known as D-14, a binary alloy containing zirconium, and D-36, a ternary alloy containing titanium and zirconium, the new alloys are readily fabricated, welded, machined, and coated by conventional methods.

Specifically designed to maintain high strength after the heat treatment used to apply coatings, the alloys are intended for space-craft and missile applications. Both can be welded to form ductile joints. They are available in sheets up to 28 in. wide and coils 24 in. wide. Coiled strip or sheet stock can be supplied down to 10 mils (0.010 in.) thick.

Alcohol reduces fatigue . . .

Fatigue crack propagation through a metal specimen is significantly reduced by the presence of an organic liquid such as dodecyl alcohol. In a study conducted by W L Holshouser and H P Utech, of the National Bureau of Standards mechanical metallurgy laboratories, for NASA, application of this liquid increased the number of cycles required to propagate cracks by factors ranging from 1.4 in stainless steel to 5.0 in a copper-beryllium alloy.

Earlier work established that certain polar organic compounds applied to the surfaces of cylinders of several metals increased their fatigue strength. This study was primarily aimed at crack *initiation*. Improvement was thought to occur because the compound formed films on the metal which prevented deleterious reactions between the metal and the atmosphere.

Propagation, after cracking starts, also is reduced by the coating. Why this happens still is not clear. One possible explanation is that the coating limits the access of oxygen and water-vapor molecules to the metal surface, reducing the rate of detrimental surface reactions. These molecules are known to reduce fatigue life.

Two materials, aluminum and stainless steel, showed a greater beneficial effect on propagation reduction by the alcohol than they did in the earlier initiation studies. This result may be associated with the relatively impermeable and adherent oxide films that form on these metals. Prior to initiation of a crack, these films protect the surface. During propagation, each increment of crack extension provides an area of clean metal surface that may react with any oxygen in the atmosphere. Little explanation can be offered as to the manner in which these components accomplish the reduction until more is known about the entire mysterious effect called fatigue.

Electrostatic printing . . .

A major innovation in printing that allows mass production while preserving artistic quality has been developed by Stanford Research Institute's graphic sciences laboratory. The process sometimes is called "pressureless printing" because no pressure is applied to the printing surface.

An outstanding characteristic of the new process is that printing can be applied to any texture—to fragile, soft, or irregular materials. Clean, sharp images can be printed on everything from low-grade newsprint to corrugated cardboard to sandpaper to glass to aspirin tablets.

Developed under sponsorship of the Electrostatic Printing Corp of America, San Francisco, it is extremely fast. In operation, a 200-mesh stainless steel screen is charged to about 1500 volts. A stencil to which the image area is transparent and the non-image area opaque is applied to the screen.

Material to be printed is placed behind the screen and backed by a solid metal plate of opposite polarity from the screen. A mixture of dry-ink pigment and resin is brushed into the screen, where it acquires an electrostatic charge. It is attracted to the paper by the oppositely charged plate.

Choose the files that have passed the toughest test of all

THE TEST OF TIME

In the 97 years we've been making files, our files have proved their superiority on every kind of job and on every kind of material.

As a result Nicholson and Black Diamond files have a brand preference second to none. This leadership comes from one fact: the best filing result for the least money. This test—the test of time—is the one significant test of file worth.

Each of the thousands of file types we make is the result of thorough and continuing research. The steel, the shape and size, the tooth pattern, the type of tooth—all have been determined by study in the laboratory of the world's largest manufacturer of files. Their correctness has been proved time and time again by users. Can you think of any more meaningful measure of a file's worth?

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WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production hits peacetime peak . . .

Production in the metalworking industry has climbed to a new peacetime peak, reaching a level of 110 on the AM/MM Production Index. **Only in the war years of 1943 and 1944,** when it reached as high as 114, was the index at a higher level.

And if the fourth quarter lives up to expectations, this all-time high may well be surpassed by the end of the year.

The slow but steady pickup in steel output is considered healthy, and is expected to continue thoroughout the fourth quarter. Production is now approximately at June levels, mill spokesmen report, with all products in good supply.

Automotive parts producers expect a very strong fourth quarter. Business right now is good for both the original equipment and replacement parts suppliers. Replacement sales are running slightly ahead of 1960, with one supplier hitting his all-time high last month.

Cutting tool manufacturers report spotty business, up one week, down the next. In general, business is up over last year, but not up as much as had been anticipated. 1961 is still expected to be better than 1960, but only by a slight margin.

Tool and die shops doing business with the electronics industry report very good business; other shops are not doing as well. In general, though, tool and die manufacturers are more optimistic now than they were several months back. They haven't seen any large tooling programs, but they feel that as soon as the 1962 cars start selling, orders will start to break.

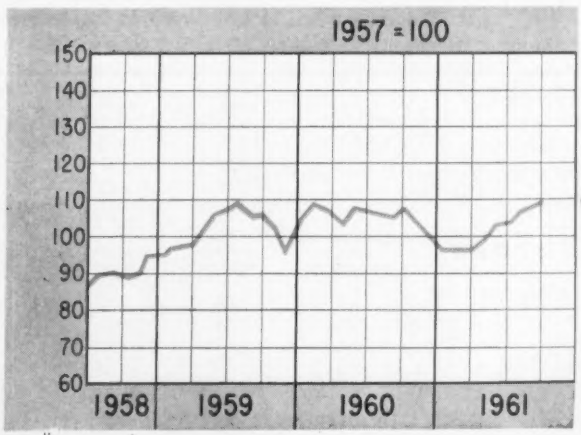
Drop forging shipments continue to show modest but steady improvement, as they have since the beginning of the year (except for summer vacation periods). Expectation is for a fair-sized pickup before the end of the year.

Manufacturers of large gears (for cranes, mills, heavy machinery) are doing especially well. Other gear makers report good but not spectacular business. One manufacturer said, "We're finally getting some orders out of the quotes we made in the second quarter. I look for a good year-end upturn—possibly ahead of last year."

Metalworking job shops report good gains, especially in consumer hard goods work. One contact said, "It looks like a good year from here. Nothing sensational, but we should be comfortably ahead of last year's totals." Another shop reports the return of some experimental and prototype work, adding that "our real good profits are in this area."

The Material Handling Institute's monthly bookings dropped 45 points in the latest month and now stands at 130.7 (1954=100). Business so far this year is about 2% below last year, but the outlook for the year as a whole is good. The current drop, say spokesmen, is not unusual. They point out that the previous months' bookings were extremely high and swelled the index out of proportion to the general upward trend.

Commercial heat treaters are counting on a good fourth quarter to make up for first-half losses. The more optimistic say that this may bring the industry up to 1960 levels, but they point out that 1960 was not a particularly good year.

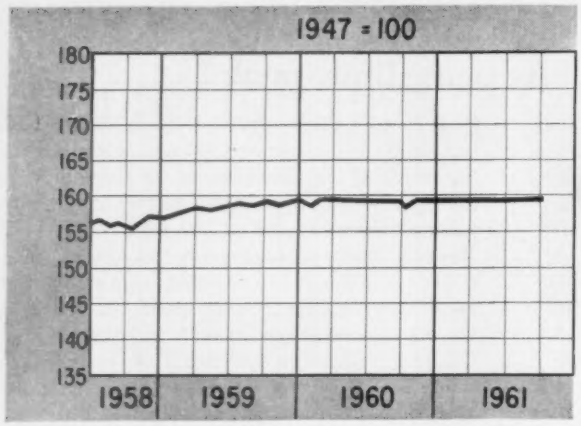


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEP Estimated	AUG Preliminary	JUL Revised	AUG Year Ago
Total Index	**110**	**109**	**107**	**106**
Machinery	105	103	103	
Electrical Machinery	120	119	113	
Autos	115	114	115	
Other Transportation .	90	91	89	
Other Metalworking ..	113	111	111	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEP Estimated	AUG Preliminary	JUL Revised	AUG Year Ago
159.6 **Total Index**	**159.6**	**159.5**	**159.5**	**158.2**
Metalworking Machinery	194.0	194.0	192.4	
Other Machinery exec. Electrical	174.2	174.3	172.8	
Electrical Machinery	156.7	157.8	159.4	
Fabricated Metal Products	147.2	147.0	147.6	

How big will the boom be?

In the past few months discussions of the business outlook have switched from the prospects for this-or-that industry to the problem of how big the coming boom will be. Most observers agree that heavy government spending in the months ahead loaded on top of already brisk business will have things humming by this time next year.

At the end of 1961, gross national product—the broadest measure of business—will hit more than $540 billion, and in the autumn quarter of next year GNP will average $571 billion.

The big question now facing businessmen is, "Will there be enough money to finance the rapid expansion of business?" For the rest of this year, the answer definitely is that there will be plenty of money available. Further ahead than that, it is difficult to say, because the Federal Reserve Board could decide to clamp down on credit if business is moving ahead so fast that further gains would only be dissipated in inflation.

Let's look at the rest of this year first. In the first half of 1961 the Federal Reserve followed an easy money policy. Bonds were purchased by the Fed from banks and the public, thus increasing both reserves and cash in the hands of the public. The discount rate was lowered, making it less expensive for the commercial banks to borrow.

Now, the policy is still easy money, but by late autumn it may not be quite as easy as it has been. Nevertheless, banks will still be able to lend. Commercial bank holdings of government bonds and other securities were 14% higher in mid-summer than in mid-summer a year earlier. Since banks earn more on loans than on investments in government bonds, they will probably be eager to sell some of their governments to get funds for loaning.

To date, President Kennedy has urged the FRB to be lenient with the monetary reins, and the chances are he will continue to urge that policy. If he does, we can look forward to ample credit at reasonable rates well into 1962.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week index of Actviity (1947-1949=100)*	155.7	156.1	145.8
Steel ingot operation (thousands of tons)	2,032	2,032	1,510
Electric power output (million Kilowatt hours)	15,869	15,838	14,298
Production of automobiles	63,516	83,421	85,879
Engineering construction awards (*Eng. News-Record*—thousands)	$69,298	$65,989	$79,260

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1957=100)*	113	112	108
Index of durable manufactures production (1957=100)*	108	107	104
Durable goods manufacturers' sales, billions*	14.83	14.69	14.73
Machinery manufacturers' sales, billions*	4.91	4.83	4.77
Durable goods manufacturers' new orders, billions	15.04	14.92	13.84
Machinery manufacturers' new orders, billions	4.88	4.77	4.52
New orders for Nonelectrical Machinery (1950=100)*	185	180	179
New Contracts for Industrial Construction (1950=100)	110	111	151

*Seasonally adjusted

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Tool Steel Topics

BETHLEHEM STEEL

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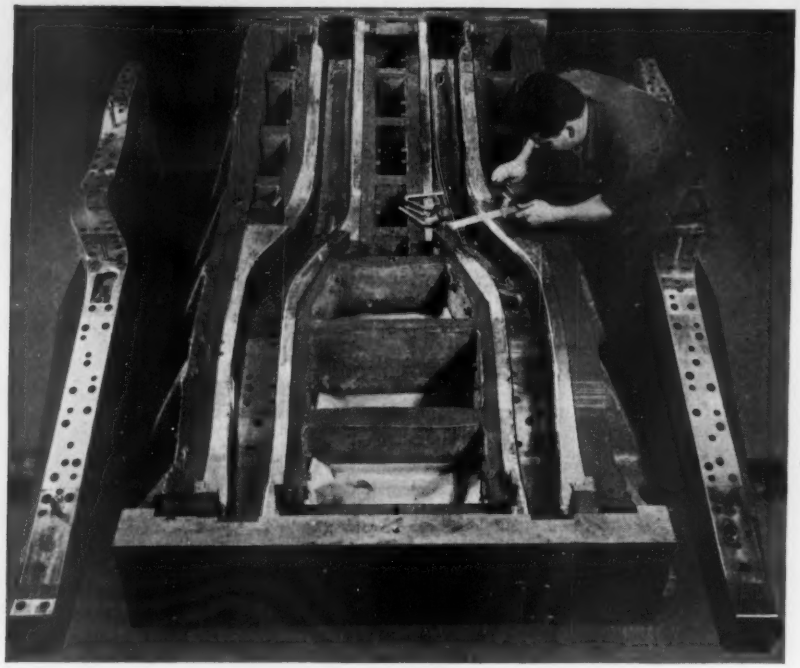

Die of AH-5 Tool Steel
Forms Sheet Steel Auto Frames

This huge die, of Bethlehem AH-5 tool steel, was made by Parish Pressed Steel Division of Dana Corporation to form automobile frames. Hardened to Rockwell C 60-62, the die handles sheet steel .120 in. thick.

Engineers at Parish like the wear-resistance of AH-5, which enables them to produce about 25,000 frames before slight redressing of the die becomes necessary. AH-5's low distortion and good shock-resistance were also singled out for favorable comment.

AH-5 is an air-hardening grade containing 5 pct chromium. It's an easy steel to machine because it can be annealed to 212 Brinell. Here's its typical analysis:

Carbon 1.00 Chromium 5.25
Manganese 0.60 Molybdenum 1.10
Vanadium 0.25

AH-5 assures economical, long-run performance from forming and blanking tools, dies, and punches. For full particulars about AH-5 or any of our other air-hardening tool steels, get in touch with your Bethlehem distributor.

• • • • •

For maximum wear use LEHIGH H

A maker of beer can openers produced several million pieces with die of Lehigh H (our AISI D-2 grade). Lehigh H provides outstanding wear-resistance in a variety of difficult applications because of its high concentration of well-distributed carbides.

It's also easy to machine. An air-hardening grade, Lehigh H has a high-carbon, high-chrome analysis.

CIRCLE 318 READER SERVICE CARD

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here Are the Facts on Clearance:

It's the Blank That Tells the Story

Operators of punching, blanking, and shearing equipment recognize that proper clearance between punch and die is necessary for good operation. The right amount of clearance produces the lowest cutting pressure and the least wear on the tools, and also makes possible clean, sheared edges which are free from burrs.

The most common rule for clearance is this: clearance should be about one-tenth the stock thickness. Yet in many shops there's a continual search for some "magic" formula that will more accurately determine the proper clearance . . . which in turn will automatically eliminate whatever type of trouble is current.

There is no need to wait for such a formula to be developed because it is not actually needed. Examination and evaluation of the blanks, or sheared edges being produced, will tell whether the proper clearance is being used. Sheared edges produced with proper clearance will show "shear" (the smooth, shiny portion) for about 1/5 to 1/3 the stock thickness; the remainder of the edge will show "fracture" (this is the rough, granular part). If the "shear" occupies too great a portion of the thickness, it indicates the clearance is too great; when the "shear" is too little, insufficient clearance is indicated. If heavy burrs are present on the sheared edges, and if the blanks are "cupped," then the clearance is too great. Burrs on portions of the sheared edges may indicate misalignment or dull tool edges which, in effect, change the clearance from the amount theoretically present.

Developing and maintaining proper clearance pays off in the production of high quality parts, and also results in minimum tool wear and low tool costs.

Micro-Chip is all alike!

It's consistent. Like dimes fresh from the mint...parts made of Micro-Chip are all alike. Kaiser Aluminum's new 2011-T3 Screw Machine Stock consistently delivers small chips...fast machining...minimum tool resetting...uniform machinability throughout each bar, from bar to bar, lot to lot. Call your Kaiser Aluminum Distributor for "Micro-Chip."

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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

How to Avoid the Big Squeeze

In this age of automation it is time that we take a good hard look at apprentice training.

What we see is alarming. Apprentice training seems to be languishing rather than thriving.

In Wisconsin alone the number of apprentices being trained under programs approved by the federal government has shrunk since World War II from 5000 to 1500.

Thirteen hundred . . .
of the nation's contract tool and die shops, out of a total of 2400, do not train a single apprentice.

As recently as 1958, when business was in a recession, many manufacturers discontinued whatever apprentice training they were doing. And a considerable percentage of them have not seen fit to resume their programs.

If automation meant the permanent displacement of skilled workers, these depressing statistics would have little meaning. But that is not the case.

Thousands of metalworking shops are far removed from automation, except for limited application, if at all. Apart from that fact, automation itself demands skilled men and specialists in the building, servicing and operating of automated machines and devices.

Just because we now have . . .
more mechanization than ever before, with the alluring title of automation, does not mean that metalworking shops can dispense with men who can make prototypes, jigs, fixtures, highly intricate parts and mechanisms.

Numerical control will eliminate jigs and fixtures from some types of machines to be sure. But it is too early to say that it eventually will do away with the need for all-around machinists and toolmakers.

We are heading into an expanding national economy. Skilled men will be in just as great demand as modern machines and technology. To wait to do something about a skilled labor supply until you must have men right away is to invite high costs and to be dependent upon pirating.

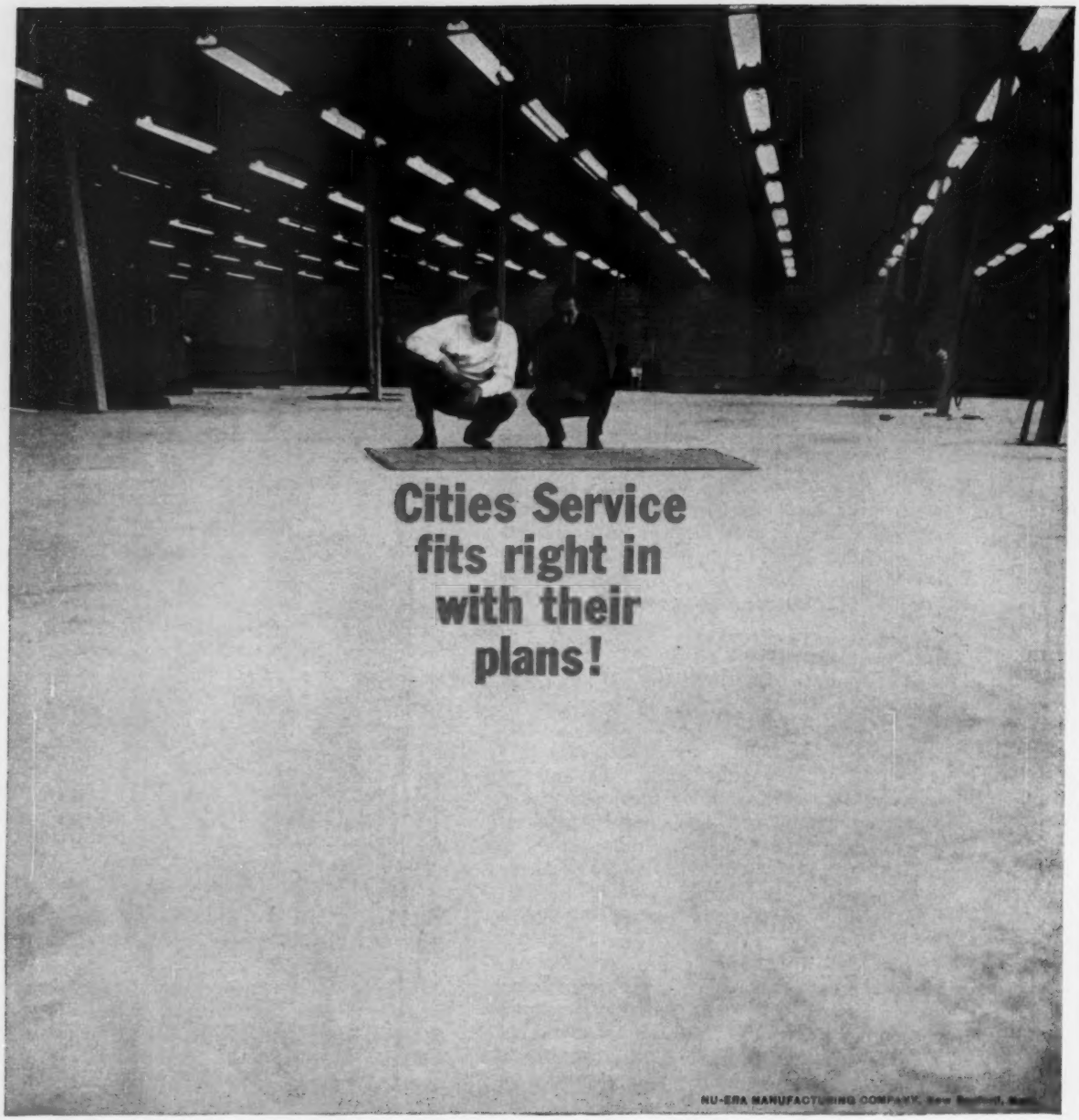
The sensible thing to do now, if you already have an apprentice training program, is to review it carefully and see that it is geared to what you believe your requirements will be in 1962 and 1963 and eventually in 1965 and 1970. If you have no program, you should begin without delay to look into what such a program can do for you.

A good, sound apprentice training program is not cheap. It will have many headaches. Some of the graduates will leave you, after you have made a sizable investment in them.

But after all the debits . . .
are written off, the assets of such a program will be tremendous. You will be underwriting your future supply of men who can translate an engineer's idea into production reality; who will be your best source for technicians capable of working with expensive tools and dies and of working from an engineer's verbal instructions as well as from blueprints; and who can be upgraded to become service men, supervisors and salesmen.

The time is ripe for a renaissance in apprentice training. As Jack Kleinoder of Volkert Stampings Inc puts it, "No pushbuttons can ever replace the skilled tool and die maker and machinist. On the contrary, more and more skills will be needed all along the line." The time to start training men in these skills is now, if you wish to avoid a big squeeze in your labor supply later on.

Burnham Finney **EDITOR**



There's a bright future ahead for Nu-Era, manufacturer of replacement gears. The firm recently built this huge plant to handle increased orders... and Cities Service definitely fits in with their plans. Says General Manager Bill Rebone, "At first, all cutting oil brands seemed to be the same. However, we soon realized that Cities Service oils were giving us superior performance in every respect. Most of our gears are made of #5135 steel, a real tough customer to work with. Yet, we find we're getting long tool life, extra clean cuts with Cities Service Chillo 30 Cutting Oil." Nu-Era now relies, exclusively, on Cities Service for their metal machining fluids. Find out how Cities Service can fit in with your plans. Simply contact your nearest Cities Service office or write: Cities Service Oil Company, 60 Wall Street, N.Y. 5, N.Y.

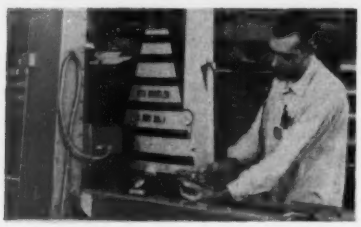
CITIES SERVICE

Out Front in Quality... Out Front in Service, too!

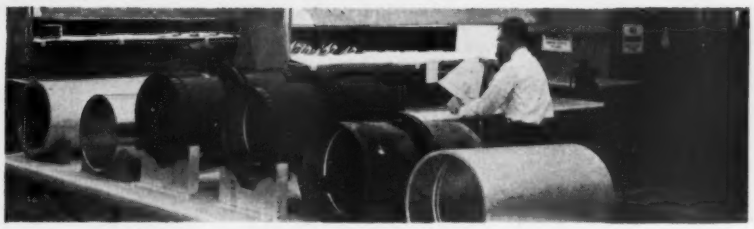
VOL 105, NO 20 **American Machinist** / *Metalworking Manufacturing* OCTOBER 2, 1961

Modern materials handling (no pallets) . . .

automatic drilling . . .



automatic contour measuring



. . . and chemical milling are all part of . . .

Tooling the "Advanced Terrier"

By George DeGroat
West Coast editor

The missile industry has some pretty specialized problems: Working with unusual shapes and materials, it must achieve an extremely high degree of reliability. And it must keep costs down in spite of low production volume.

General Dynamics/Pomona (Calif) has solved these problems, to some extent at least, by applying mass production techniques to building the Advanced Terrier, a new solid fuel, surface-to-air missile. The result is a missile that doubles the performance of the original Terrier, which has been operational with the U. S. Fleet since 1956.

Chemical milling

One of the most advantageous manufacturing methods in use at the General Dynamics - operated Naval Weapons Industrial Reserve Plant at Pomona is chemical milling. With this technique, such cylindrical parts for Terrier as aluminum aft sections and warhead casings are machined quickly and accurately without highly skilled operators and costly milling machines, complicated setups, or special tools.

More than 17 lb of material are removed from each aft section when inner surfaces of complex shapes are chemically milled to a depth of 0.317 in., ±0.002 in. The 2014 aluminum sections are heat treated to T-6 conditions for best surface finishes in etching (125 microinches rms, in this case).

Chemical milling is not limited by machining restrictions on shape, direction of cut, or by radius of cutters. Not only can it be applied to complex contours, but metal may be removed from both inner and outer surfaces at the same time. Various depths of cut on one part are possible by progressively removing the maskant material, and tapering is practical for sheets, extrusions and other parts suitable for stiffeners.

The process can be applied *after* forming if desired, and any number of parts can be processed at once, depending upon their size and the capacity of the etching tank.

Three simple basic steps are followed: making the part, scribing the mask to remove it from areas to be etched, and etching. At the outset, it is essential that the parts be thoroughly cleaned prior to masking to insure close adherence.

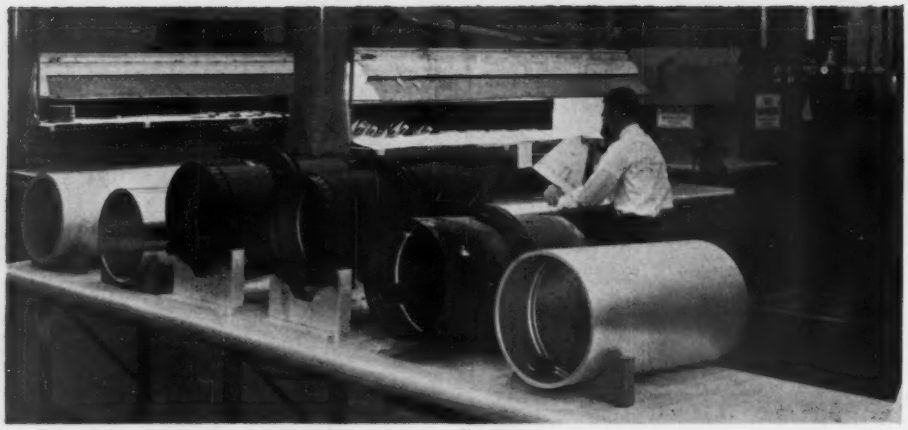
Vapor degrease first

Masking procedure for the 2014 aluminum aft section is typical. First step in preparing for masking is a vapor degrease, followed by a preetch in Penn Etch No. 1 solution for 50 to 60 seconds. After rising, smut is removed from the parts in a deoxidizing solution, (Wyandotte No. 2487). A cold and then a hot water rinse follows this operation, after which the parts are allowed to dry and cool to room temperature.

Maskant material is chosen for its adhesion, scribing and stripping qualities; resistance to the etched solution, and flash point (for safety). For this work, the maskant selected was Boray Mfg Co's CS-2037, which has a flash point of 90 F.

Viscosity of the material is carefully checked and adjusted to 45-55

Tooling the "Advanced "Terrier"



Chemical milling of internal contours in aluminum aft sections of the Advanced Terrier progresses, left to right, from (1) an "as received casting," (2) the casting after turning, drilling, etc (3) the masked part, (4) the masked part scribed to remove unwanted masking material, (5) the chemically milled section, and (6) the completed section—milled, cleaned, and with masking material removed

Automation in missile manufacture: Drill unit setup processes four different Terrier parts. Except for eight access holes in one of the parts, this unit does jobs that previously required four special machines. In addition, a number of holes, once made on conventional machines with separate fixtures, are produced by this setup

SSU to insure its adhesive qualities before work is immersed in it. The parts, placed on holding fixtures, are dipped into constantly agitated maskant, allowed to soak for several seconds and are then removed — allowing the excess maskant to drip back into the tank.

Air drying for at least a half-hour follows, after which the parts are oven dried at 160 F for 10 minutes. They are then cooled to room temperature and rotated 180 degrees on the fixture. Then the dipping and drying process is repeated until four coats have been applied.

Scribing the maskant to cut away unwanted material inside the cylindrical section (the most critical part of the process) is carefully controlled by accurate templets, which guide the operator's knife. These templets are fitted and positioned precisely to insure a high degree of dimensional accuracy in etching later. Removal of the templets, after scribing the maskant, leaves only peeling away of unnecessary masking material before the part is ready for etching.

Before etching begins, however, the original dimensions of the areas to be etched are checked, and test panels of the same material and heat treat condition are etched for a specified length of time to determine the etch rate. The etch rate and required depth of cut help determine a time cycle made up of four equal periods. Concentration of the etching solution is held within 22 to 26 ounches per gallon. Solution temperature is 180 F.

In etching, the parts are rotated 180 degrees at the end of each time period (25% of total etching cycle) to avoid tapering, and a thickness is made at the end of each time period. When the fourth time period is completed, the work is removed from the tank, rinsed, and a small hole is cut into the mask to accommodate a micrometer or caliper gage tip.

If a thickness check shows the part to be over the required dimensional limits, a lead tape is applied over the window and the part is returned to the etching solution. When the desired depth of cut is reached, the part is rinsed and cleaned and the mask is stripped away.

Automatic hole production

Automation has been applied successfully to machining of Terrier parts in the form of a 16-station rotary universal drilling and boring machine, built on the "building block" principle. The unit, which consists of standard components manufactured by Drillunit Inc of Detroit, is designed to handle all hole machining requirements of four different Terrier components. It can be rearranged to accommodate other parts, too, should the occasion arise as the result of design changes or other reasons.

A central circular base supports a Geneva drive indexing table and a coolant system. Attached to the base are eight wing-angle brackets, which support Drillunit quill-type thrust units and dovetail-guided, multiple-spindle drill heads.

Each of the four parts machined at Pomona has its own holding fixture, which in turn is attached to a common adapter-base permanently

Automatic measurement of airfoil contours of Terrier fins is done on this tape-controlled setup, designed and built at General Dynamics/Pomona. Main components: positioning assembly, an electric cabinet, a control console. Accessories include a tape punch unit with a keyboard assembly that punches the tape

mounted on the top surface of the machine's 16-station, dial-index table.

The fixtures locate by a common center plug and are radially positioned by a diamond-locator. Clamping is done with three cylinder-actuated swing clamps and a hydralic hand pump. Drill and ream bushings are mounted in castings secured to the toe of each drill head station's riser casting.

Cutting tools are all equipped with Scully-Jones adapters to reduce change time to a minimum. An extra set of tools in a tool control board is ready for immediate use, and the operator sets sharpened tools to the correct depth at his bench while the machine automatically performs in proper sequence. Cycle time for the four parts varies from 12 to 38 minutes, and setup time from 40 to 50 minutes.

Materials handling

In addition to these advanced manufacturing techniques, improved materials handling methods aid production of Terrier missiles, whose precision components and delicate electronic assemblies make conventional methods of materials handling inadequate. Special equipment and methods have been developed to protect the missile components from dust, shock, vibration, abrasion, impact, and other damage during production.

Flexibility was an important consideration in the selection of the equipment — to permit economical conversion in the event of missile design changes. The new equipment consists of a basic shop trailer, a basic section rack, a rack conveyor, and a final assembly monorail system. Couplings on the trailer and rack conveyor allow motorized-trailer-train transportation between various production departments.

The shop trailer is designed to receive either the basic section rack or special superstructures. Components can be installed in the basic section rack to suit production needs. The rack conveyor is easily converted to carry drawers, special racks, or accessories, to accommodate production components as required.

This basic equipment (used in conjunction with various sizes of tote pans, special handling boxes, and stationary storage racks) provides an integrated, flexible, efficient, and economical method of in-process handling of delicate parts and assemblies.

Rejections caused by damage have been sharply reduced since installation of the new system, which facilitates normal flow of parts between operations.

Surface geometry check

Optical equipment no longer checks airfoil forms at various stages in the making of Terrier fins. Instead, a tape-controlled aero-dynamic surface analyzer, designed and built by General/DynamicsPomona, does the job automatically—and does it better.

With this device, the changing airfoil contour along the axis of these fins is checked infinitely, rather than at specific stages (as was the case with optical checking equipment), and the important location of an indexing pin hole is established.

Major factors that influence deviation of the missile from its ballistic path are dihedral, camber, and effective incidence in the airfoil contour of its fins. For this reason, the new machine completely inspects the airfoil contour of Terrier fins, computes the required data, and presents the operator with tabulated information showing the amount of dihedral, total effective incidence, and camber.

These data, (which indicate airfoil quality) are used in locating an indexing pin on the mean aerodynamic chord at the base of the fin.

Tape-controlled machining

All machine operations (except drilling the indexing pin hole) are controlled from data contained on a punched tape. These data include servo positions for horizontal and vertical planes, computer constants identification symbols, and other control information.

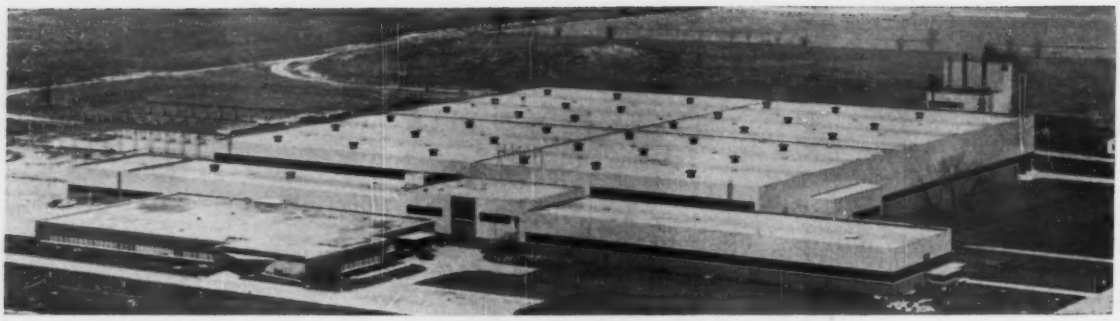
There are three main components of the unit; a positioning assembly which supports the fin and does the actual measuring; a cabinet containing the electronic system; and a control console which includes the control panel, the tape reader, and two printers.

The basic unit of the positioning assembly is a horizontal ways section consisting of a modified lathe bed, a modified lathe saddle on which the fin is mounted, and a servo system for accurately positioning the saddle (and thus the fin) in the horizontal direction.

A vertical ways section is located at approximately the center of the horizontal section. This includes a support, two pairs of precision ways, transducer mounting blocks, and a servo system for accurately positioning the transducer mounting blocks.

Actual measurement of the airfoil contour is done with transducers on mounting blocks (one on each vertical way) which are positioned in the vertical direction by the vertical servo system. Drilling of the indexing pin hole, after the airfoil contour is checked, is performed with a semi-automatic hydraulically operated drill unit.

Mechanical alignment of the positioning assembly is so critical that changes in temperature may be enough to cause measurement errors. Consequently, a system installed on the unit monitors temperature changes in seven locations on the positioning assembly. When a critical temperature change occurs, the system alerts the operator by means of visual signals so that necessary adjustments may be made. •



Natco's new 365,000-sq-ft plant, situated four miles west of Richmond, Ind

New product line, plant for Natco

A brand new 365,000-sq-ft ultra-modern plant was the showcase early this month for introduction of a new line of machine tools by National Automatic Tool Co. The occasion: Natco's 60th annivesary.

Slated for production by Natco under a cross-licensing agreement with Ateliers G S P of Courbevoire, France, and shown at a recent open house was a twin-spindle numerical control machine. This unit, which caused much comment two years ago at the European Machine Tool Exhibition in Paris and is now offered in the US for the first time, has two automatic tool changers and two spindles.

One of the spindles—for milling, boring and other operations requiring extreme rigidity—has an automatic tool changer which can handle 18 tools. The second spindle is designed for high-speed, average-sized drilling, reaming, and tapping. The automatic changer for this spindle handles up to 36 tools.

Other features of the machine: positioning of table and head determined from measuring bars with built-in temperature-compensating devices; ability to accept compensating code information (between theoretical tool length and actual tool length) without disturbing the original tape.

More N/C

Natco also showed its new single-spindle numerical control machine, which has an automatic tool changer that can handle 32 tools, and which can provide fast tool change of random selection without need for coding of the individual tools.

Also from Europe, by way of a cross-licensing agreement with Delepena and Son Ltd of England, and scheduled for U S production by Natco, is a new line of Natco-Delepena induction heat treating equipment. In a demonstration, gear teeth were case hardened under water, and the involutes were later checked to show there was a minimum of distortion.

Also making their debut at the open house were the new Natco/Jes-Cal honing machines. A mechanical feed hone was demonstrated honing connecting rods, which were later gaged on Sheffield equipment to prove that production honing can consistently hold tolerances within 0.0003 in. total on size, taper, and roundness.

Supplementing the Jes-Cal hones (which come with mechanical or hydraulic feeds) was a new line of Natco-Delepena vertical and horizontal honing machines for honing long bores with above-average diameters. (Vertical hones take bores from 2 to 8 inches in diameter up to 5 feet long; horizontal hones the same range of bore sizes up to 10 feet long.)

Other machines displayed

Among other machines on display at the newly opened plant:

- A mechanical-feed gun drilling machine, shown drilling a variety of deep holes in alloy steel.
- Natco H6 and F5B multi-spindle drilling and tapping machines.
- A plastic injection molding machine (Model 400) with 60-ounce capacity.
- New Natco "building block" mechanical feed and hydraulic feed units in sizes from ¾ to 30 hp.

The new plant has a main manufacturing area consisting of six bays, each 500 feet long and about 75 feet wide; plus about 40,000 sq ft of office space. Situated on a 140-acre site, the plant is located about four miles west of Richmond, Ind. •

One of six 500-foot-long, 75-foot-wide bays for manufacture and assembly of Natco's new and standard lines of machine tools. Plant's facilities were previewed at an open house held earlier this month

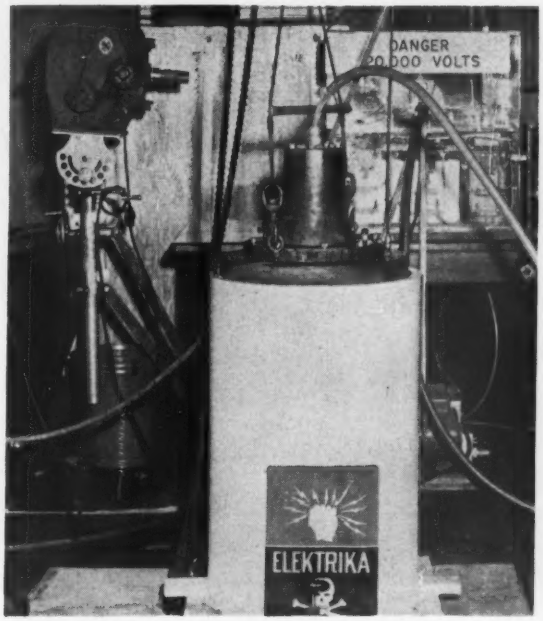
NASA studies high-energy forming

How to form the 300 to 400-in.-diameter aluminum alloy bulkheads—in one piece, or with a minimum number of welds—for future Saturn and Nova space vehicles. That's the problem now facing NASA scientists at the Marshall Space Flight Center, Huntsville, Alabama.

Aluminum bulkheads up to 105 in. (for the Saturn rocket booster) are currently being formed by hydrospinning. Because this technique is considered impractical for the larger sizes of bulkheads that will be needed, recent work has centered around high-energy-rate forming—spark discharge, magnetic forming, and explosive forming.

Spark discharge experiments are, at present, being carried out in the 18-in.-dia x 36-in.-deep blast chamber illustrated at the right. This has been used to form 5- and 10-in.-dia hemispheres. Under construction now is a blast chamber about ten times this size. It will be seven feet wide by eight feet deep and will have a 240,000-joule capacitor bank.

Called "Medusa" because of the myriad coaxial cables feeding current from the capacitor bank to the exploding bridge wire, this larger unit will be used for both spark discharge and magnetic forming studies. Its capacitor bank will generate between six and seven million peak horsepower, with discharge currents of up to a million amperes. Pressures will be measured in millions of pounds per square inch.



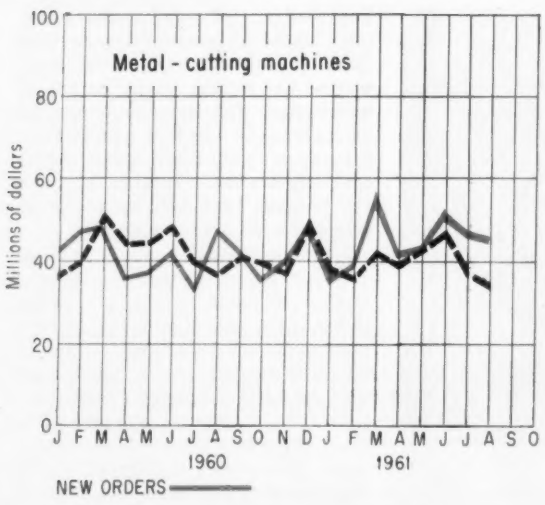
NASA's blast chamber forms 5- to 10-in. hemispheres

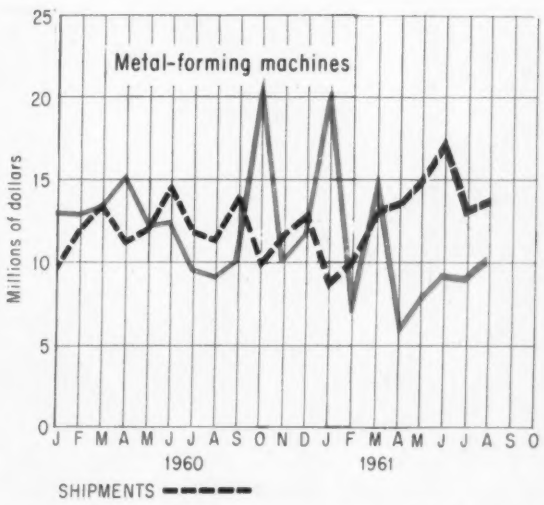
Explosive forming may be solution

After some eighteen months of tests, the Methods R&D Branch has just about reached the conclusion that neither the spark discharge nor magnetic forming techniques are capable of handling blanks of the size needed for Saturn and Nova. The solution, says one spokesman, now appears to be explosive forming, in which a sheet of metal is forced into a hemispherical die by shock waves resulting from detonation of a chemical explosive.

Marshall Center's explosive forming research and development is being handled by industry. Contractors include Ryan Aeronautical Co and the Propellex Division of Chromalloy Corp. •

NMTBA Index of machine tool new orders and shipments



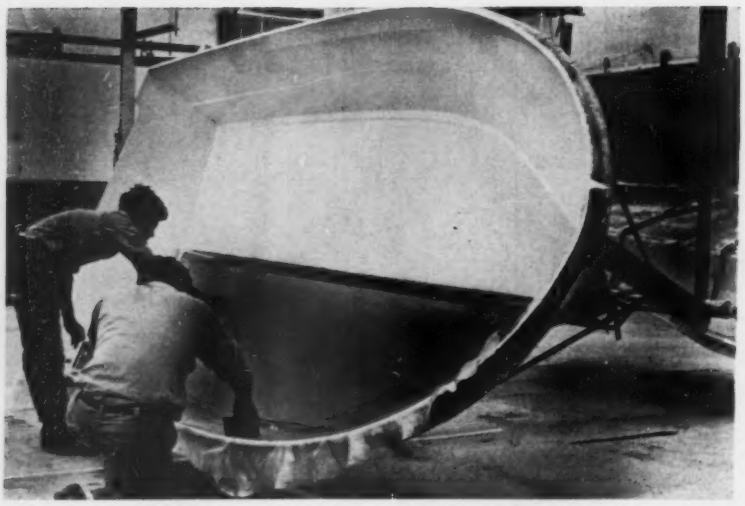


Net new orders for metal-cutting machine tools declined in August to a figure of $45,950,000 from a July level of $46,700,000, according to preliminary figures from the National Machine Tool Builders' Association. Shipments of metal-cutting machines dropped from $37,200,000 in July to $34,550,000 in August. Orders for metal-forming machines rose in August to $10,050,000, up from July's $8,950,000. Shipments rose from $12,550,000 in July to $13,400,000 in August

1 . . . Male master is built up from sheet-metal templets arranged along a steel frame and held apart by spacer pins. Wire mesh is laid between templets, and plaster is built up flush. This is sanded and coated with a glass mat and resin-base paint. After sanding, rubbing and waxing, surface is sprayed with parting compound

"Impossible" technique speeds plastic boat building

Paint it, THEN build it

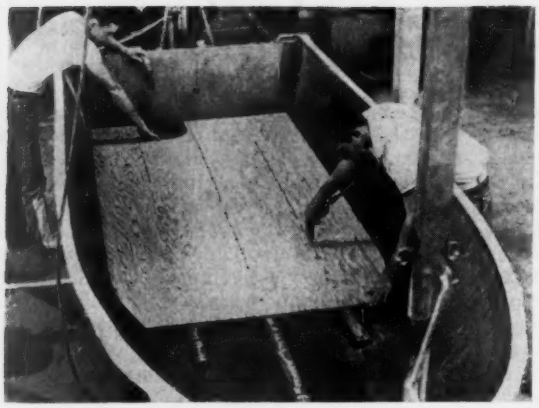


2 . . . Female molds made from the male master are installed on the conveyor and sprayed inside with colored gelcote. A layer of glass cloth is placed over the gelcote, saturated with resin, and carefully smoothed down. A mat of glass fiber is then installed and saturated with resin, followed by a second layer of glass cloth.

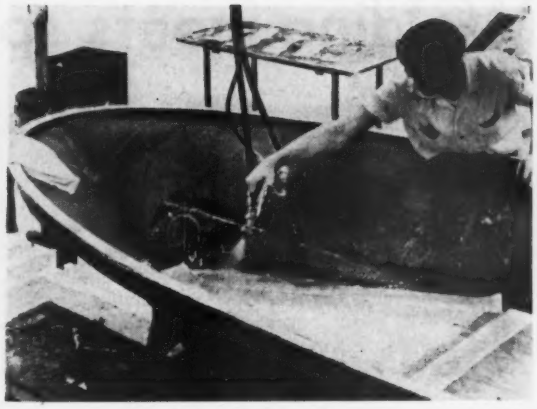
Supposedly, you can't paint something that isn't there. Yet Lone Star Boat Co, Plano, Texas, actually paints its plastic boats before it builds them. They're made in a mold, of course, and the first manufacturing step is to lay down a coat of gelcote solution that contains the color the finished boat will be. No other painting is done on the outside.

For a new model, a master is made of steel templets, wire mesh, and plaster to conform to the outside shape of the boat. This is coated with glass mat and resin paint which is carefully sanded, waxed, and coated with parting compound. From this, female production molds are made by laying down layers of resin-saturated glass cloth and glass mats until the required thickness is obtained. Steel reinforcing members and pivot points for the trunnion fixtures are incorporated at the same time.

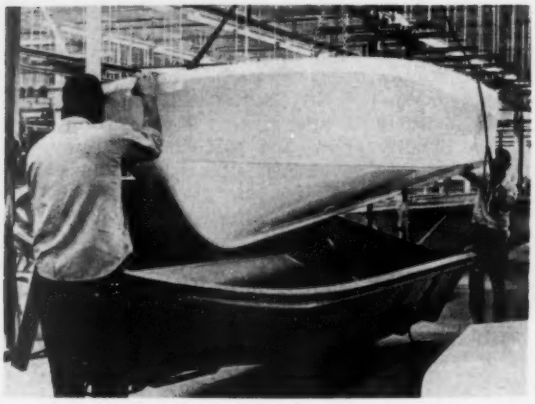
Once the molds have been made,



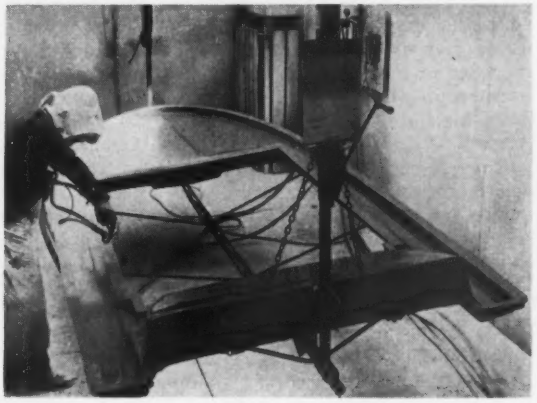
3 . . . After structural members have been installed, heavy plywood floorboards are anchored in place. These are covered with glass cloth and saturated with resin



4 . . . Covered floorboards are bonded to the sides of the hull by placing strips of glass cloth over the seams and spraying with resin to form a watertight seal



5 . . . After air curing, the finished hull is lifted out of the mold and transferred to a wheeled dolly for removal to the assembly station where the deck is installed



6 . . . Decks are built up of glass cloth and resin on the same conveyor line. Here the first coat of colored gelcote is being sprayed on the female mold

the entire production process is performed on a stop-and-go overhead conveyor that carries the molds in trunnion fixtures from station to station. By tilting the molds from side to side, all interior surfaces are easily reached by operators standing on the floor.

Work flow in the plant is planned for a minimum of waste motion, and liquid resins and solvents are piped to the points of use from a central chemical building which houses four storage tanks, each with the capacity of a regular tank truck. Liquids are heated to the proper working temperatures as they flow through the sealed lines.

The plant covers 8 acres and has a capacity of 25,000 plastic, wood, and metal boats a year, as well as 6000 boat trailers. Finished boats are stored indoors, and an adjustable-height loading dock is provided to suit truck and trailer beds. •

7 . . . Finished deck, with windshield and trim, is lowered onto the hull after inside has been sanded, painted, and interior trim and steering mechanism installed

Welding meets space age challenges

New equipment, improved techniques, and variations of existing processes are all called into play to solve the joining problems caused by today's growing family of "wonder" materials—and also to improve quality and lower costs in joining the more commonplace materials.

Of the newer processes, electron-beam welding was probably the most discussed during last week's Fall Meeting of the American Welding Society in Dallas, Texas. No less than five technical papers had at least something to say about it.

Three papers mentioned it as only one of the tools tested during attempts to solve specific joining problems. However, R E Roth and N F Bratkocivh of GM's Allison Division reported on tests that compared electron-beam welds with Tig (Tungsten, inert-gas) dry-box welds in a variety of materials.

They found that "the electron-beam process does not markedly enhance the weld strength properties of conventional materials." However, on the favorable side, the tests indicate that the process can weld a low-alloy, hardenable steel (Ladish D6C) in the final heat treated condition at high strength levels when necessary.

Further, in welding a refractory metal (Mo—0.5% Ti alloy sheet) it produces a weld-joint efficiency 20% higher than Tig welding does. And, because of the electron-beam's high depth-to-width ratio, it can make certain welds that other processes cannot reach in odd-shaped parts.

New jobs, new problems

Among the problems raised by the newer materials was one tackled by Battelle Memorial Institute—welding 2-inch-thick titanium-alloy plate for possible service in deep-diving submarines. Such welds must have high strength in combination with good ductility and toughness.

In reporting on this project, R L Koppenhofer, W J Lewis, G E Faulkner, and P J Rieppel said that welds made in Ti-6Al-4V alloy with matching filler wires were stronger than the base plate and had transverse tensile ductility about equal to that of the base plate. The Mig-welding process was employed inside an inert-gas welding chamber.

Another interesting problem involving titanium was how to weld it to steel so it can be employed in relatively thin sheets to line process equipment. According to D R Mitchell of Titanium Metals Corp, the joint requires a third material between the titanium and the steel to act as a buffer zone.

Best results were produced with vanadium as the buffer in joints made by the Tig process. In resistance welding, vanadium again makes the best buffer, but these joints were made with austenitic stainless steel instead of low carbon steel.

New tools for better welds

Among the new equipment items introduced at the meeting was a Mig-spot-weld control that gives programmed preheat, pentration, weld buildup, and postheat for producing the required weld nugget. The control was developed at Marshall Space Flight Center, Redstone Arsenal, to maintain joint quality in the thicker aluminum sheets needed for larger space vehicles. The paper was presented by D M Daley, Jr, W M McCampbell, and J C McCaig.

Another control, this one a feedback control for resistance welding, was discussed in a paper by C F Paxton and R S Zeller of Weltronic Co. During the first cycle of a spot weld, the control senses the voltage drop at the electrodes and then adjusts the heat, time, and pressure to make a good weld.

Increasing applications of aluminum plate have spurred work at Kaiser Aluminum & Chemical Corp toward economical techniques for welding thicknesses greater than an inch. J A Liptak reported on the latest one, which employs electrode wires as large as 7/32 inch in contrast with ⅛ inch in conventional Mig welding for aluminum.

Mig equipment won't handle the larger wire sizes, but submerged-arc equipment will, after a few simple changes that convert it from flux to gas shielding. Kaiser claims deposition rates of 10 to 15 lb per hour.

E F Gorman of Linde Co discussed a new concept in the control of gas flow and said that "it may considerably alter the design of arc-welding torches." Instead of the usual elongated flow chamber, a torch can now have a section only about ¼ inch long, containing a porous medium that controls the flow pattern and provides "excellent shielding of the weld area, even at high torch elevations." •

Scale model helps get bugs out of biggest US-made hobber

When Detroit's Michigan Tool Co set out to build a hobber for 200-inch-diameter gears that would be accurate to tenths, the company's engineers felt that blueprints alone wouldn't give them the whole picture. The result of this feeling is the ⅛ scale model on the cover which gives engineers a chance to study the machine—the largest of its type ever built in this country—in 3-D.

The model enables designers to pinpoint installation, operation, and maintenance problems before the actual 300-ton machine is built, and it has already produced several changes in the final plans.

Installed in the Lester, Pa, (Steam Div) plant of the Westinghouse Electric Corp around the middle of next year, the 48 by 28 by 18 ft. vertical hobber will sit in a special reinforced-concrete pit that has piles going down to bed rock.

The machine's huge table will support workpieces up to 60 tons which are hobbed into helical, spur, and worm gears. Helical gears can be cut conventionally, (with index and feed gears; differential locked out) or differentially (with index, lead, and feed gears).

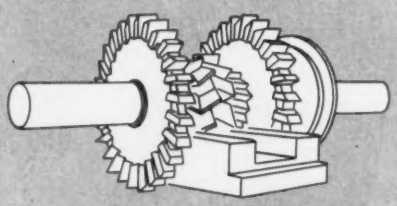
Because of the size of the gears hobbed on this machine precautions have been taken to guard against ruining expensive workpieces.

- Electrical controls will transfer the load to storage batteries if normal power fails so that finishing cuts will be uninterrupted.
- Backing up the batteries is a generating unit that will take over until normal power is restored.
- Thermocouples will monitor temperatures at critical points in the machine, and several separate lubrication and coolant systems will prevent temperature build-up. •

55 COST-CUTTING IDEAS

More ideas on milling start this third episode of a four-part series by Harold Sizer, director of design at Brown & Sharpe, Providence, RI. The series is keyed to stimulate designers and production men to think 'economy'

33



STRIVE FOR SAMENESS in gang cutter diameters. When a surface is to be gang milled, the general level should be kept as constant as possible to keep cutter diameters approximately the same. This avoids reducing feed because of a "weak link" and eliminates large diameter cutters

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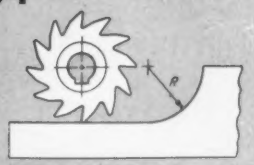

WHEN SPECIFYING RADIUS on cuts like this, pick a radius that will let operators use a stock size cutter

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CHAMFERED CUTTERS have longer life. Therefore, whenever possible, design pieces to be milled with chamfered corners, since this allows the use of chamfered cutting tools

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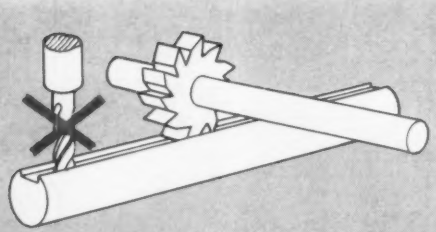

TRY DESIGNING KEYWAYS and similar slots for cutting with periphery cutters. Cuts that must be made with small end mills require slower feeds and more frequent cutter replacement. Note: After sharpening, an end mill will not cut the same width slot

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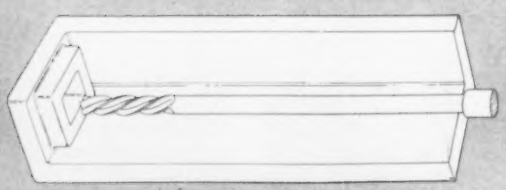
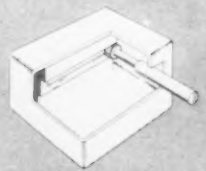


AVOID LONG REACHES, since cutter is not rigidly supported. Even at the slow speeds this requires, there is apt to be vibration, and an uneven surface results



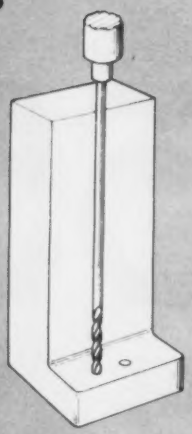
CASTINGS SHOULD BE designed to eliminate long-reach milling

55 COST-CUTTING IDEAS

MACHINING HOLES

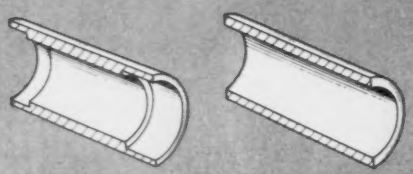
So much shop time is spent machining holes that a few dollars saved here and there will really add up. A little thought at the drawing board can save hours of work out in the shop, and profits won't suffer from interdepartmental cooperation

38



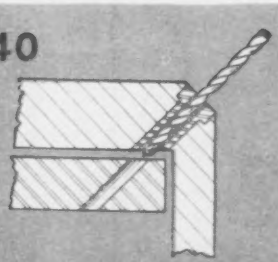
A LONG REACH impairs accuracy, and provision for support close to the point of drilling must be made. Without this support, the drill will wander and greatly limit the accuracy

39



BORING ALL THE WAY THROUGH eliminates the need to reverse the position of the workpiece. There are two savings from this: (1) It removes the possible human error in repositioning; (2) It saves considerable time

40



DRILLING AT AN ANGLE is expensive for it requires corner milling or special tooling

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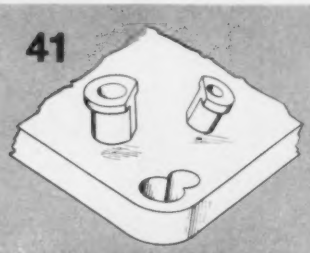

HOLES CLOSE TOGETHER require special jig bushings that must often be ground

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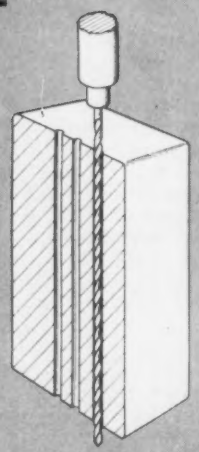
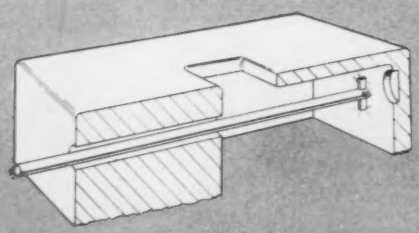


DEEP HOLE DRILLING has several disadvantages. It is time consuming. Also, if holes are very deep, they tend to lead drill off center, reducing accuracy. Finally, extra-deep holes may require expensive special drills

43



BLIND BORING almost guarantees a trial-and-error method of machining —thus, machining costs are unavoidably high. Also, because of the vibration common to unsupported tools, surface finish is likely to be poor

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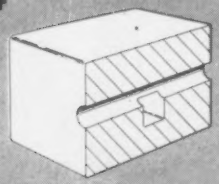

CORED HOLES interrupting hole to be machined causes tool deflection. Also, sand and scale from core impair finish

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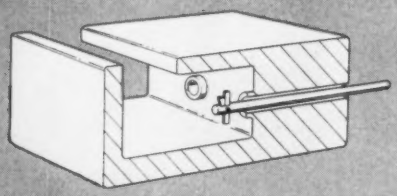

BACK FACING, since it offers no positive machine stop, depends for accuracy on the operator's skill in a "cut and try" method. In mounting cutter, spindle must be run through hole and then cutter locked in place. This mounting time, plus the cut and try method, contributes to high costs

WELDING

As an important part of metal fabrication, welding is a field where lots of cost cutting can be done. Ideas on this subject, which start here, will be continued in the fourth and last installment of this series designed to help save shop dollars

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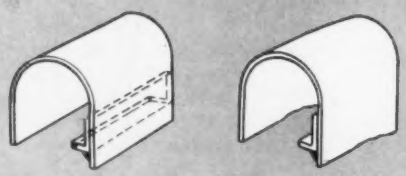

BE SURE TO SPECIFY WELD SEQUENCE so that distortion can be canceled out by counter-distortion. To keep distortion at a minimum, specify spot welds in preference to arc welding whenever possible

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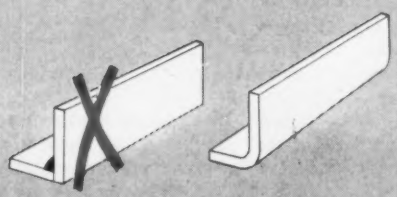

REMEMBER ALL THE DIFFERENT WAYS of fabricating metal in the shop. To keep costs down, keep the amount of welding down — be sure to check to make sure each weld is needed. Bend rather than weld if possible

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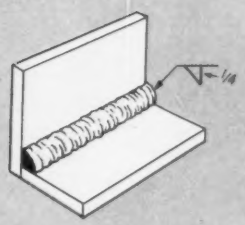
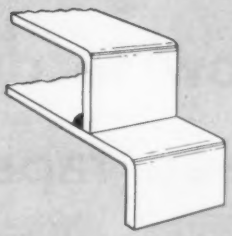
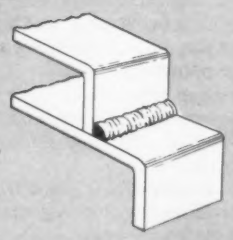


AVOID OVER-WELDING by specifying type of weld, bead size, and proper location



WHEN APPEARANCE is important, the design should lend itself to inside welding



IF APPEARANCE DOESN'T matter, be sure to say so. There will be less finishing and joints may be stronger

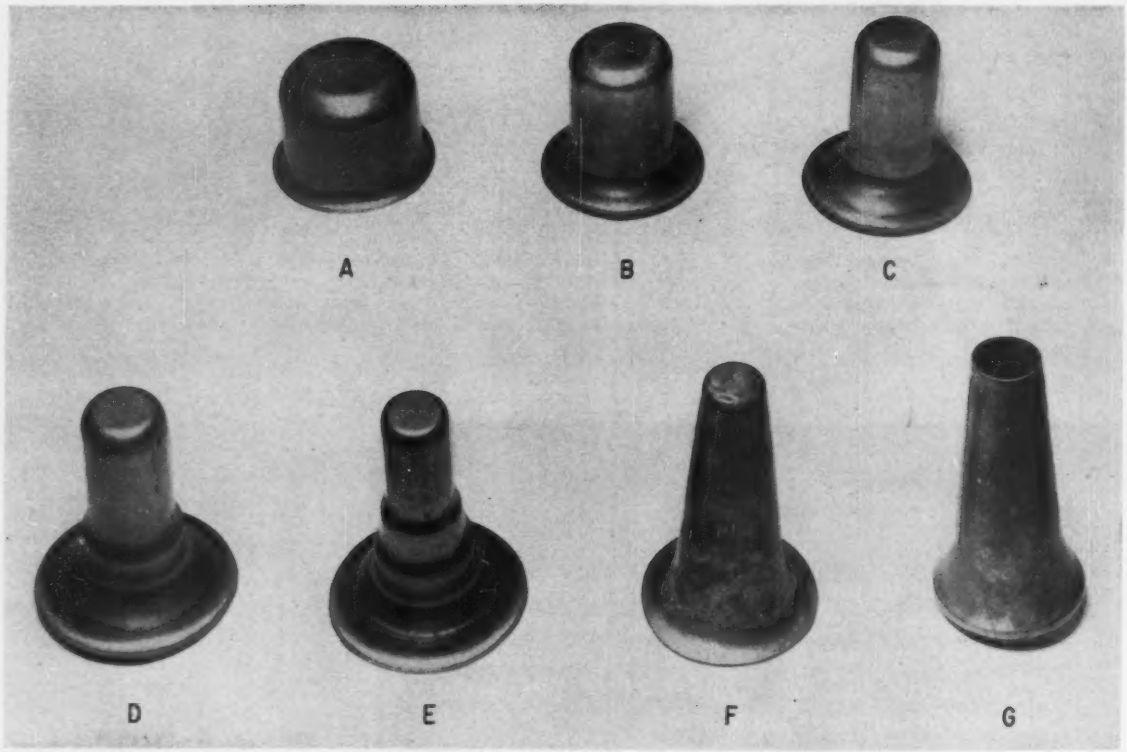


Fig. 1—Eight operations produce a smooth-contoured shell for a candelabra. The top end is trimmed on a spinner's lathe, the bottom is pinch-trimmed in a die, which also draws a ⅜-in. straight section to fit a mating part

How to draw deep tapered shells

By Mark Golden

Making of dies for deep-drawn shells is in itself an art requiring specialized knowledge of the plastic flow of metals, ductile strength of the metal being drawn, and the limits that the metal will stand in successive reductions.

But when the deep-drawn shell is tapered, the job becomes much more complex. Then, two new factors must be considered:

- How deep each reduction can be without overstretching the metal during finish forming.
- How to avoid marking the shell at the point where a reduction stops.

Because competition is fierce in those fields using tapered shells (lighting fixtures, novelties, hardware), extra finishing costs and scrap resulting from lack of knowledge of such basic diemaking procedures cannot be tolerated.

All dies used in making the tapered shell shown at G in Fig. 1 were comparatively simple. The finished part is 3-15/16 in. high, ⅞ in. in diameter at the small end, and 2 in. in diameter (± 1/32 in.) at the bottom.

To make this part a 0.032-in. (20-ga) copper blank was processed through eight operations, including trimming off the small end in a spinning lathe, using a wood chuck.

Basic problem involved working out a succession of redrawing operations, so that the blank could be transformed to a shape easily stretched to the final contour. Fig. 2 shows the configuration produced (dash line) by these redrawing operations.

Four operations were performed in single-action presses, and three in double-action presses. Reductions were made in four steps:

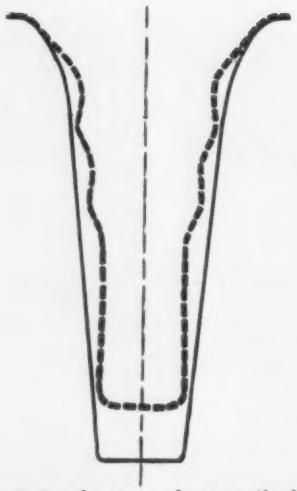


Fig. 2—In planning reductions (broken outline), it is essential to allow just enough metal for stretching into final shape—plus drawing at the open end

- **Draw** to 2.290 in. by 1-15/16 in. depth in a single-action press.
- **First redraw**—1.717 in. by 2⅜ in. deep (25% reduction).
- **Second redraw**—1.373 in. dia, 2⅞ in. depth (20% reduction).

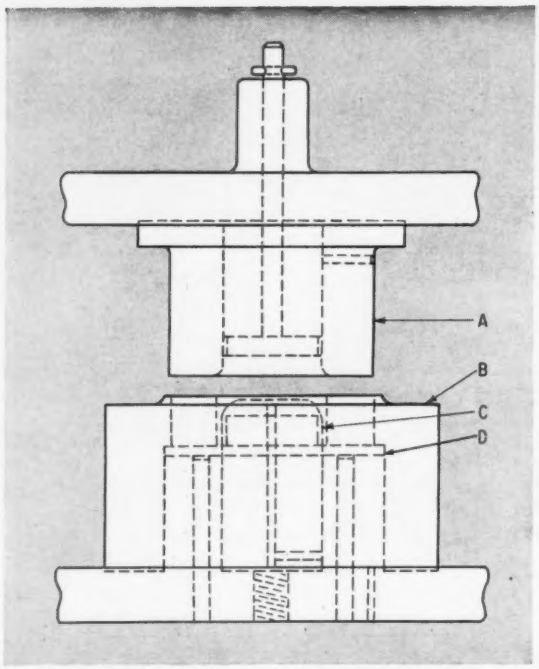


Fig. 3—A combination die blanks the metal and draws a cup with generous radiuses at the flange and bottom A 45° angle and well-rounded corners are used on plug *C*

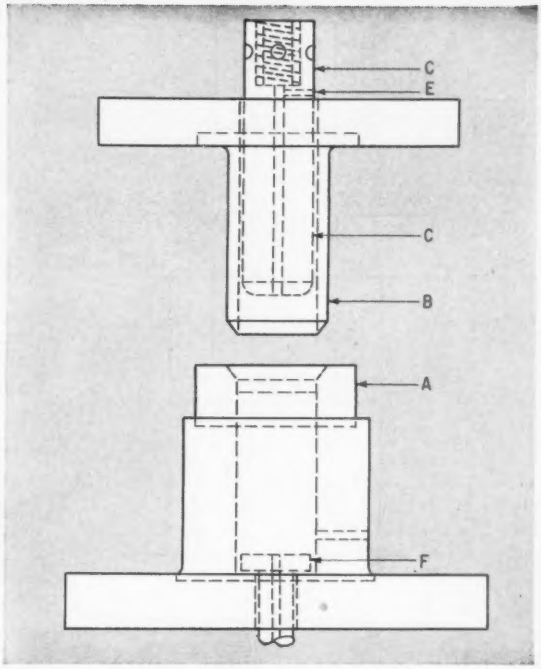


Fig. 4—Redrawing dies for steps *C*, *D* and *E* (Fig. 1) are designed to produce reductions that closely approximate the final shape (not the maximum movement of metal)

• **Third redraw**—1.098 in. dia for a 2 in. length only, increasing shell depth to 3-3/16 in. (20% reduction).

• **Fourth redraw**—0.878 in. dia in for a length of 1⅝ in. Shell height: 3-7/16 in. (20% reduction).

The small reductions for the last two operations eliminated the need for blank holders. Instead, a locating ring was substituted on top of the drawing die to centralize the shell and keep it upright.

In determining the blank size for a shell of this type, ordinary formulas do not apply—because of such unknown factors as plastic flow and permissible amount of stretching.

For this particular shell, I took the length of one side plus the bottom diameter (which equals 4⅝ in.). This proved to be the exact size of blank required.

The number of reductions was determined by making the layout shown in Fig. 2. This shows the outline of the finished shell and the outline before stretching. Each reduction was drawn to allow a stretch of between ⅛ and ¼ in. at major points. The bottom was stretched ½ in. because the punch would have an ironing effect on the side walls and stretch the metal downward.

This action reduced the flange diameter of the shell from about 2¾ in. to 2⅜ in. The stretched shell has a height of 3-15/16 in. (Note that all radiuses on the punches, dies and blank holders were a generous ¼ in.—to make for an easier draw and reduce the possibility of a mark on the shell at a point where the reduction stopped.

Cupping operation

For the first operation, a combination die (Fig. 3) was used. Punch *A* cut the blank against die ring *B*. Continued descent drew the metal over plug *C* against the resistance of pressure ring *D*, which was supported by hardened pins and a rubber spring barrel. Note: the upper part of plug C had a 45° angle and well-rounded corners, and the inner edge of *A* was also well-rounded. Air vents are used in *A* and the plug.

The first redraw was made over a plug set in the die shoe. A pressure ring surrounded the plug and was supported by four pressure pins.

To ease metal flow, the pressure ring and the mouth of the die had matching 45° angles, and the latter had a ¼ in. radius from the angle to the inner wall. The reduction was continued until it met the radius formed by the first punch.

Two additional redraws were carried out in tools like that shown in Fig. 4, except that blank holders were not necessary for the fourth and fifth operations. The die ring *A* had a generous 45° angle and a large radius, and similar angles and radiuses were used on the blank holder *B* and the punch *C*. After the fifth operation the shell looked like *E* in Fig. 1.

Stretching operation

When stretched in the die shown in Fig. 5, the shell had an included angle of 11° and the radius on the upper part was 1-⅞ in. In the annealed condition the shell had a diameter at the upper part of about 2-¾ in., and a height of 3-½ in. Actually, the die height did not need to be the full height of the finished shell, because the latter could be pushed part way through the die hole, and pushed back again by a knockout.

On the upstroke, the blank holder stripped the shell from the punch. Thus (as shown in Fig. 2) the metal was stretched to conform to the punch, and drawn in from the upper end to increase the height by 7/16 in. This operation was done on a double-action draw press.

Pinch trimming

Two additional operations were necessary to get the finished part (shown at *G*, Fig. 1). First, the shell was chucked on a spinner's lathe to

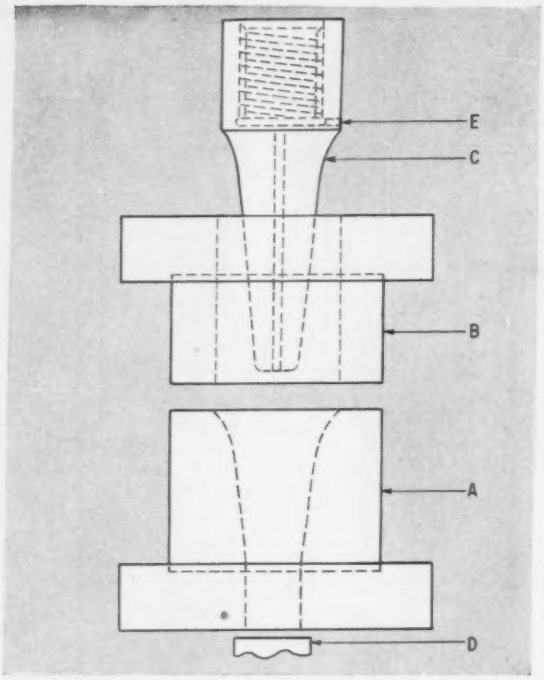


Fig. 5—Stretching the annealed copper shell (after step *E* Fig. 1) is relatively easy. Because large radii were used on the previous tools, no marks show up on the tapered shell

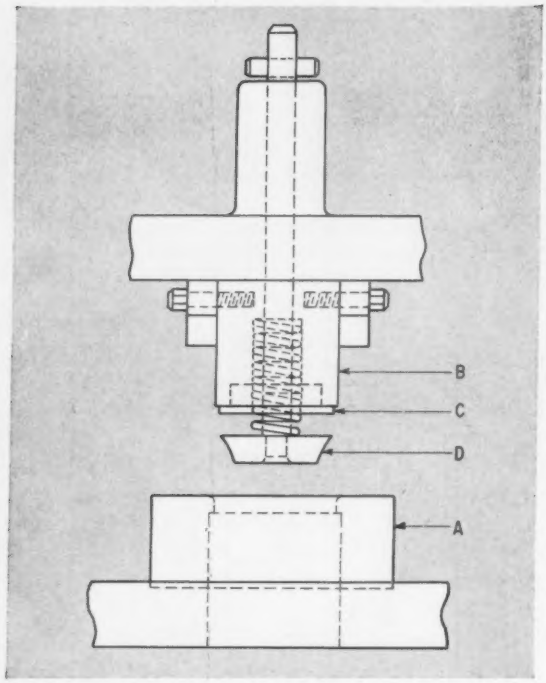


Fig. 6—Insert *C* forms a ⅛-in. straight wall at the mouth of the shell, before the sharp edge of punch *B* trims against the radius on die *A*

cut off the bottom end square with the axis. Because the shell could not be held with a ball-bearing tail block, a maple chuck was used. If a shell chanced to slip after use, some rosin was applied to the chuck.

Second, the shell was pinch-trimmed by the die shown in Fig. 6. Actually, two operations were done by this tool—drawing the ⅛-in. side wall and, finally, pinch trimming.

Certain tricks in die design are evident in the pinch-trim die. Die *A* is ground to an ID of 2.035 in., and the surface is ¼ in. high. The top edge has a 1/32-in. radius, and the bottom edge is sharp to strip the shell.

Punch *B* is the same diameter as the die. Insert *C* forms up the side wall of the shell before the sharp edge of punch *B* pinches off the scrap ring. Insert *C* is made two thicknesses less than the die opening. Knockout *D* centralizes the shell and aids in stripping. Two knives cut the scrap ring, which slides up the punch.

When finished, the shell has a smooth contour, no visible marks at the several reductions, and two cleanly cut square ends. Therefore, the part is suitable for plating and, ultimately use as part of an ornamental candelabra. •

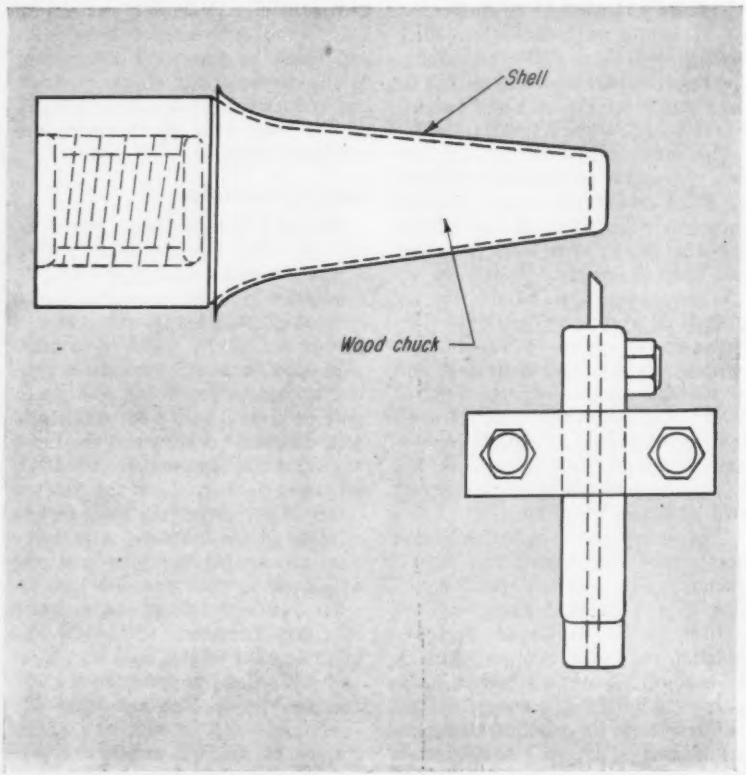


Fig. 7—Trimming of the shell is done on a maple chuck. An occasional application of rosin prevents any slippage of the shell while subjected to trimming pressure. A wood chuck is better than use of a ball-bearing tail block

American Machinist / *Metalworking Manufacturing*

Special Report No. 511 Oct. 2, 1961

A new look at TOOL ANGLES

By F J McGee,
senior manufacturing research engineer
and G S Slay,
manufacturing research engineer
Aeronautics & Missiles Division
Chance Vought Corp, Dallas, Texas

Many of today's engineering materials are labeled "hard to machine." Tomorrow's may be even more difficult to cut. Yet industry goes along with two or three standard tool geometries for each type of cutting tool, and expects them to handle all kinds of jobs. Here is a thorough analysis of cutting tool angles and a technique for finding the optimum cutting tool geometry for any job—in any material

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Basic tool geometry

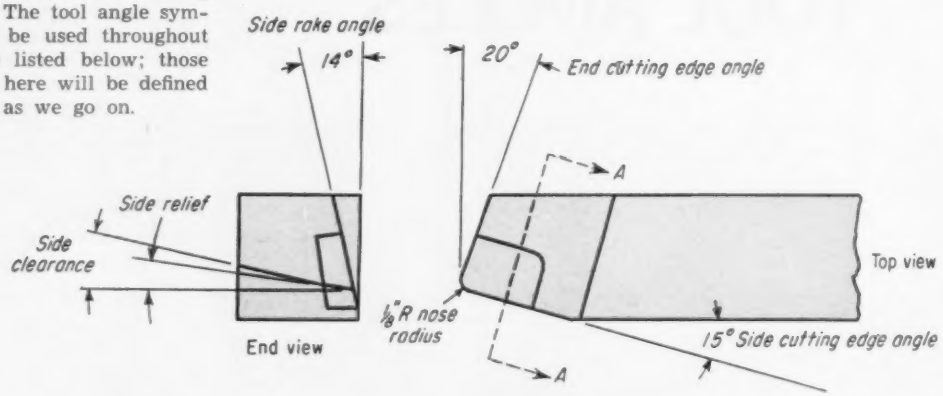
Probably the most common of all cutting tools is the ordinary lathe tool. It is a single-point tool with two cutting edges—the side cutting edge and the end cutting edge. Complete geometry for a typical lathe tool is given below.

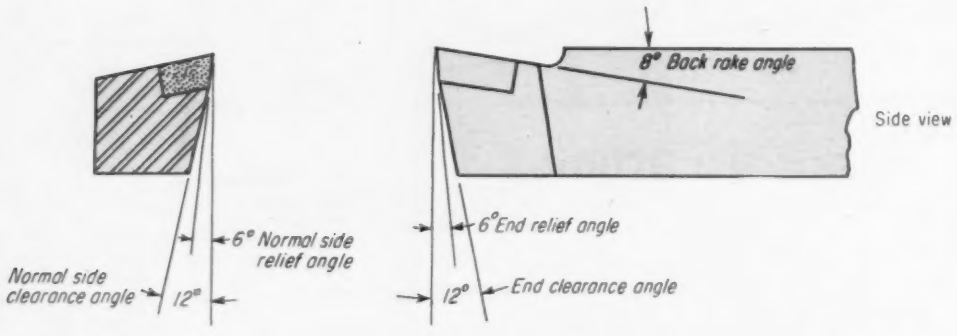
Because of its simplicity, the lathe tool will be used as an example throughout this report. The geometry for other types of cutters, such as face mills and plain mills, will be related to that of the lathe tool later in the report.

The tool signature (above, right) is a shorthand way of describing tool geometry. The tool angle symbols that will be used throughout the report are listed below; those not illustrated here will be defined and developed as we go on.

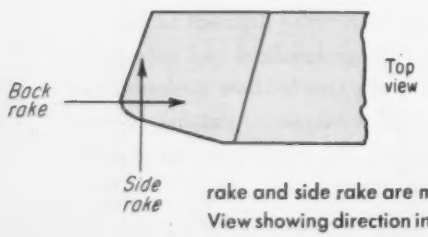
Tool Signature — 8, 14, 6(12), 6(12), 20, 15, 1/8

- Back Rake
- Side Rake
- End Relief
- End Clearance
- Side Relief
- Side Clearance
- End Cutting Edge Angle
- Side Cutting Edge Angle
- Nose Radius





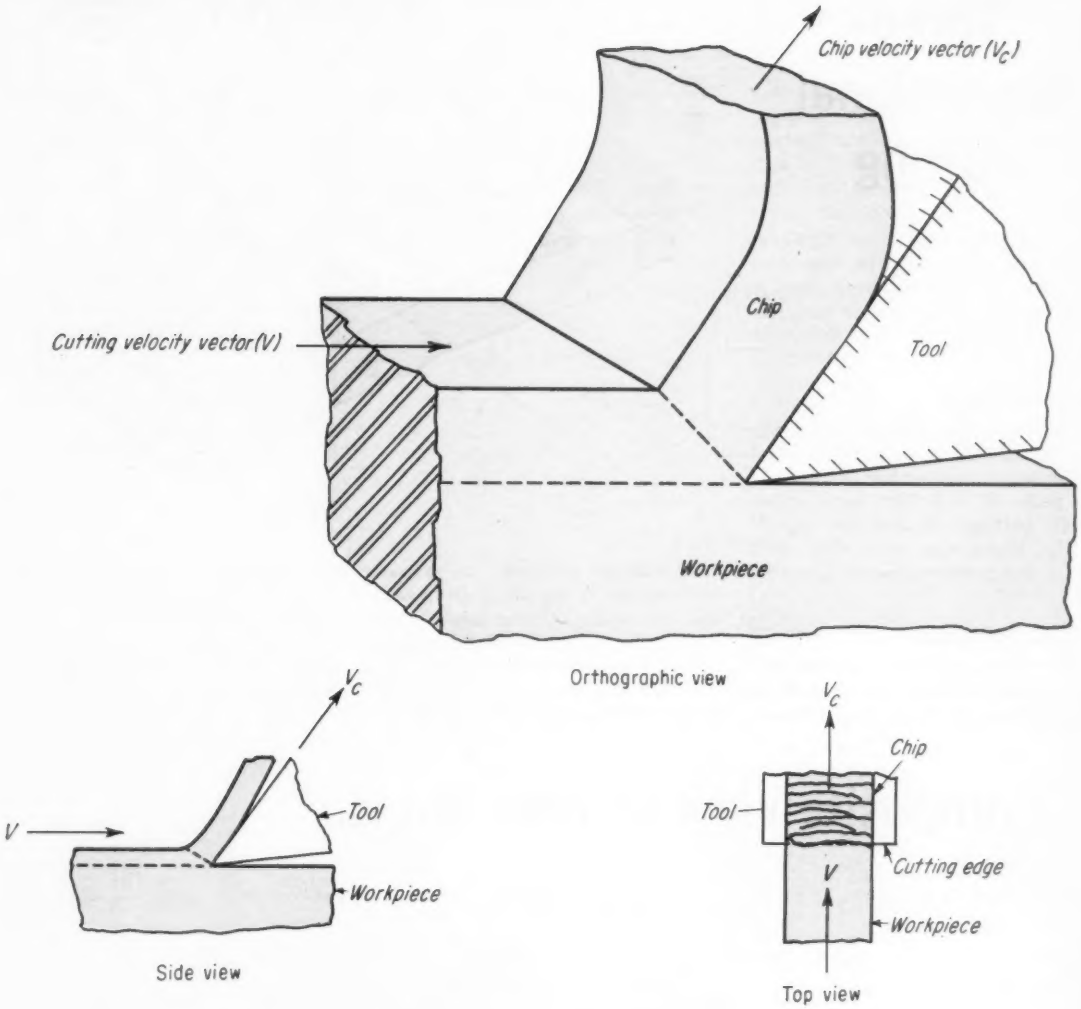
End section A-A



View showing direction in which back rake and side rake are measured

SYMBOLS

α_b = Back Rake	α_v = Velocity Rake Angle
α_s = Side Rake	α_e = Effective Rake Angle
θ_{e_1} = End Relief	η_c = Chip Flow Angle
θ_s = Side Relief	α_r = Radial Rake Angle
c_e = End Cutting Edge Angle	α_a = Axial Rake Angle
c_s = Side Cutting Edge Angle	CA = Corner Angle
r_n = Nose Radius	V = Cutting Velocity Vector
i = Angle of Inclination	V_c = Chip Velocity Vector
	α_n = Normal Rake Angle



Orthogonal cutting

Orthogonal, or right-angle, cutting can be more simply described as two-dimensional cutting. Actually, the mechanism of orthogonal cutting can be described by the use of a single plane (side view, above). This plane, like all planes, has only two dimensions, length and breadth.

Obviously, such a cutting operation has another dimension, width, as shown in the top view. Here, the tool cutting edge is perpendicular to the cutting velocity vector **V**. The plane of any cross-section taken through the cutting zone, perpendicular to the finished surface and parallel to the cutting velocity, is identical to the plane shown in the side view.

Hence, the side view is fully descriptive of the cutting operation throughout the width of the cut.

Cutting velocity vector

A vector is a line that represents the size of some physical quantity and the direction in space in which this physical quantity acts. In this case, the cutting velocity vector **V** represents the velocity of any point on the workpiece and the direction in which this point moves through space as it approaches the cutting tool.

As a simplification, the cutting velocity vector is assumed to act tangentially to the workpiece, at the cutting tool, in a lathe turning operation. The scalar value (magnitude) of this vector is generally expressed in surface feet per minute or, for short, sfpm.

Chip velocity vector

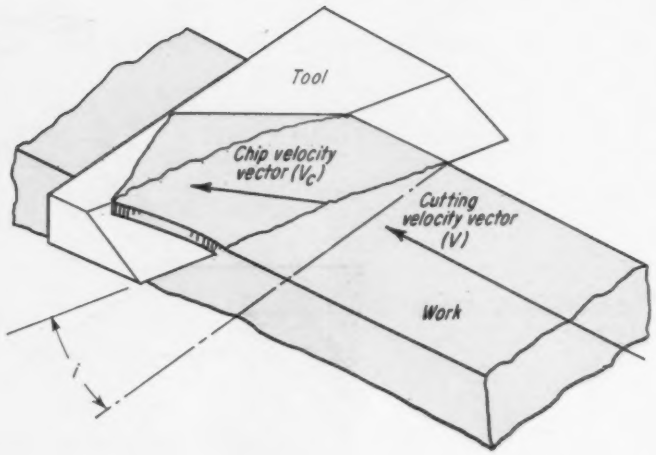
The chip velocity vector $\mathbf{V}_c$ represents the velocity of the chip as it leaves the shear plane and the direction it takes in space, relative to the cutting velocity vector, as it is deflected by the cutting edge.

For orthogonal cutting, the chip velocity vector is essentially parallel to the tool face and perpendicular to the cutting edge.

Typical orthogonal cuts

Because of their simplicity, orthogonal cuts are used extensively in metal cutting research. Production applications include surface broaching, finishing planer cuts, lathe cut-off operations, and some plain milling cuts.

Three-dimensional cutting



A three-dimensional, or oblique, cutter can most easily be described as a straight cutting edge that is inclined from a normal to the cutting velocity vector. (See sketch at right.)

Inclination angle

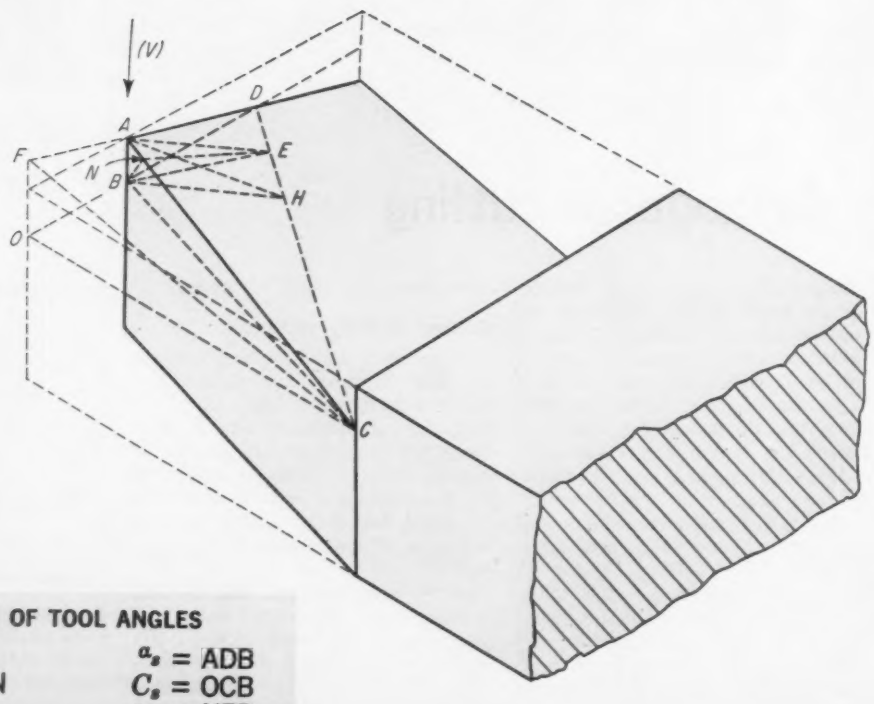
The inclination angle i is the distinguishing feature of all three-dimensional cutting and represents the point of departure from orthogonal cutting. Inclination significantly alters the chip flow and, hence, the performance of a cutting tool.

Two cutting edges

The most practical three-dimensional tools have two edges that cut simultaneously. Take the ordinary lathe tool, for example. The primary cutting edge is the side cutting edge; the secondary cutting edge is the end cutting edge. Because the depth of cut is usually much greater than the feed per revolution, what happens along the side cutting (primary) edge is of much greater importance than what happens along the end cutting (secondary) edge.

Typical operations involving three-dimensional cuts include lathe turning, face milling, slab milling, and drilling.

Composite view of rake angles



DESCRIPTION OF TOOL ANGLES

a_v = AEB	a_s = ADB
i = ACB = ABN	C_s = OCB
a_e = AHB	a_n = NEB
a_b = FCO	η_c = EAH

Inclination angle

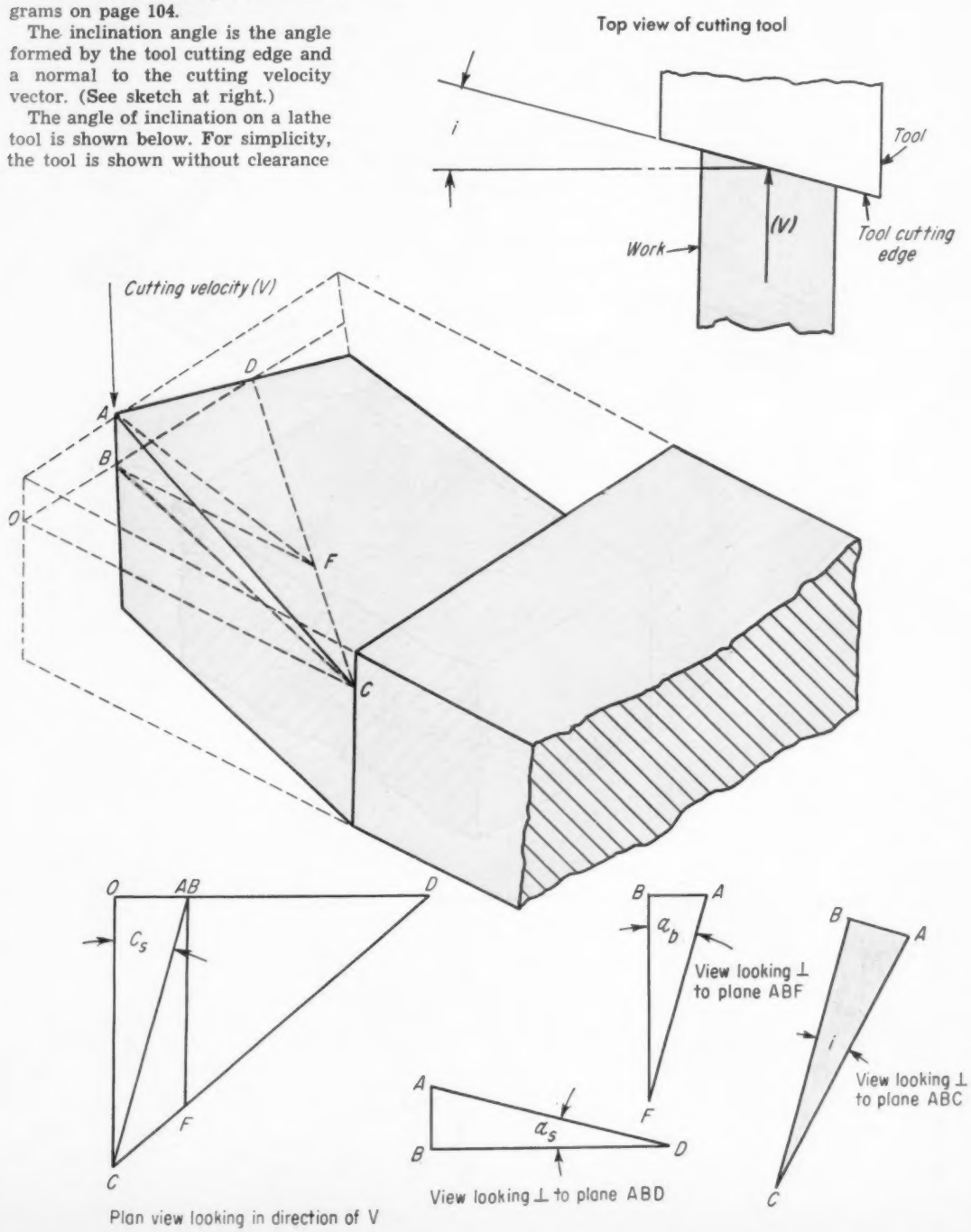
There are four important tool angles that cannot be easily visualized or measured: the effective rake angle α_e, inclination angle i, normal rake angle α_n, and the velocity rake angle α_v. Each angle will be derived. Values can be found trigonometrically or be read directly from nomograms on page 104.

The inclination angle is the angle formed by the tool cutting edge and a normal to the cutting velocity vector. (See sketch at right.)

The angle of inclination on a lathe tool is shown below. For simplicity, the tool is shown without clearance or end cutting angles. Plane OBDC is drawn perpendicular to the cutting velocity vector.

The known angles, α_s, α_b, and C_s, are indicated, along with the inclination angle, on the auxiliary diagrams below the lathe tool. Knowing that triangles ODC and BDF are similar, and knowing the trigonometric relationships of the other triangles, we can show:

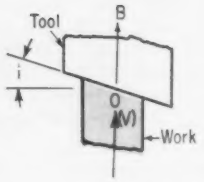
$\tan i = \tan \alpha_b \cos C_s - \tan \alpha_s \sin C_s$



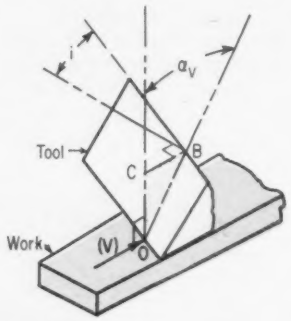
Velocity rake angle

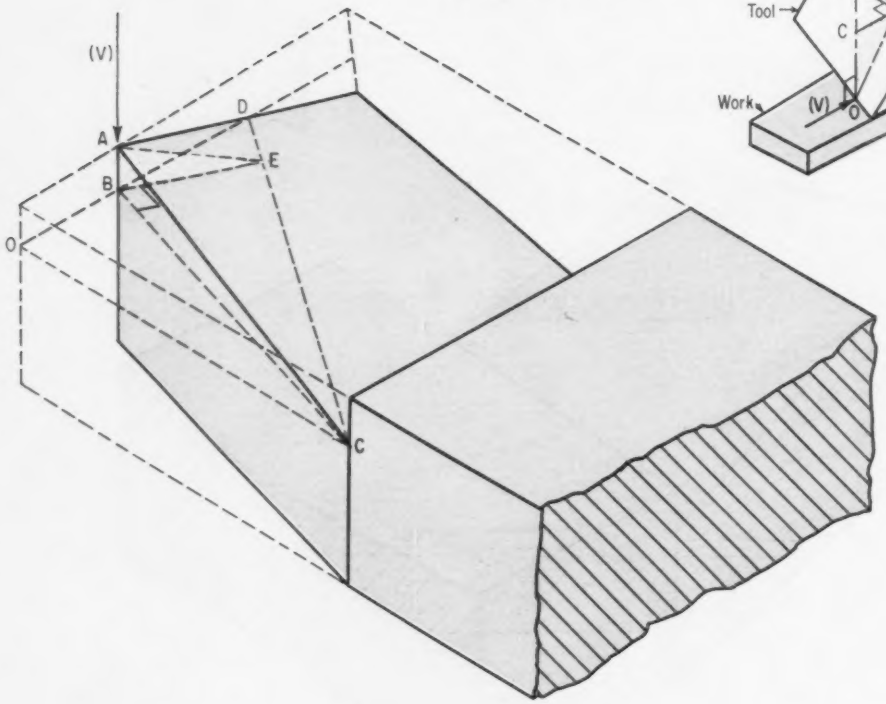
The velocity rake angle α_v, sometimes incorrectly referred to as the true rake angle, is the angle formed by the tool face and a normal to the finished surface in a plane containing the cutting velocity vector (plane OCB in the lower of the two sketches at the right).

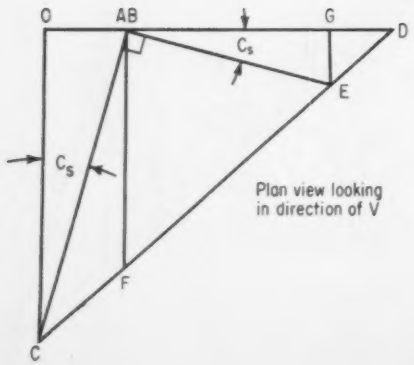
The velocity rake angle is shown as angle AEB on the lathe tool. From the auxiliary diagrams we can show: $\tan \alpha_v = \tan \alpha_s \cos C_s + \tan \alpha_b \sin C_s$

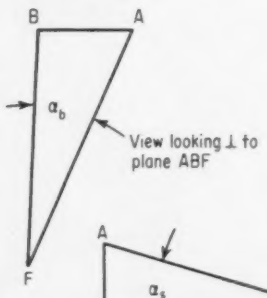


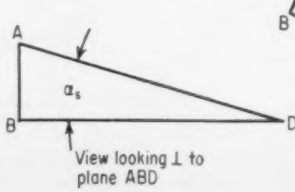
Velocity rake angle ► on oblique cutting tool

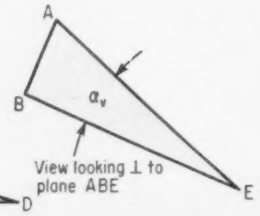












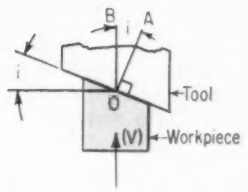
Normal rake angle

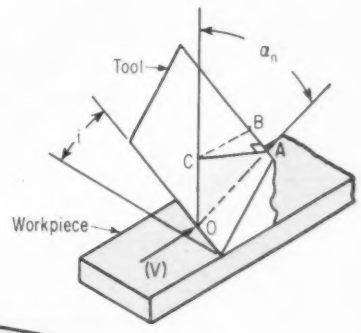
The normal rake angle α_n, sometimes called the oblique rake angle, is the angle formed by the tool face and a normal to the finished surface in a plane perpendicular to the cutting tool edge (plane OCA in the lower of the two sketches at the right).

This angle is shown as angle COA on the lathe tool. Note the relative positions of the velocity rake angle COB and the normal rake COA.

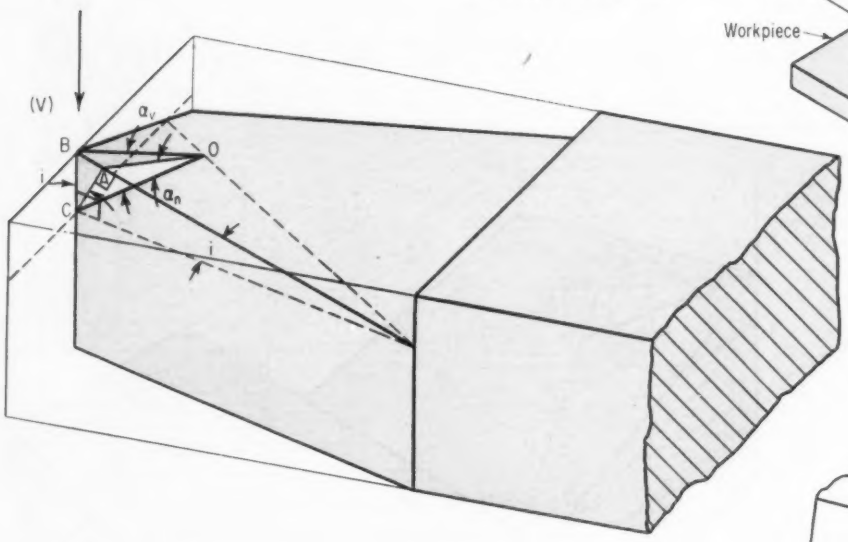
The normal rake angle can be calculated from the relationship between the velocity rake angle and the inclination angle. From the auxiliary diagrams we can show the relationship between the normal rake angle, velocity rake angle, and inclination angle:

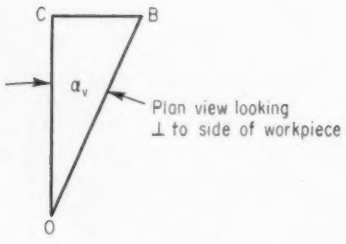
$$\tan \alpha_n = \tan \alpha_v \cos i$$

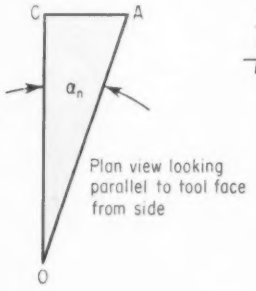


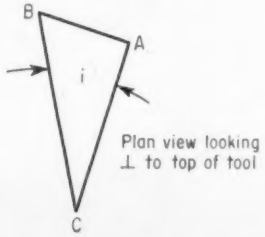


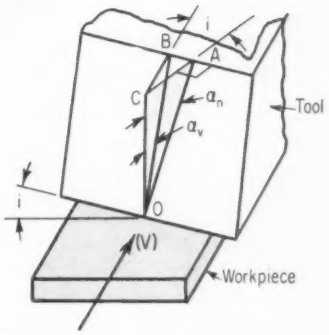
Normal rake angle ►
on oblique cutting tool











Velocity rake, normal rake,
and inclination angle
on oblique cutting tool

Effective rake angle

The effective rake angle α_e is the complement of the angle between the cutting velocity vector and the chip velocity vector. The angle $(90° - \alpha_e)$ is the angle through which the chip is deflected by the cutting tool. (See sketch directly below.) Note that the plane in which α_e lies is not perpendicular to the finished surface, but is inclined from the normal.

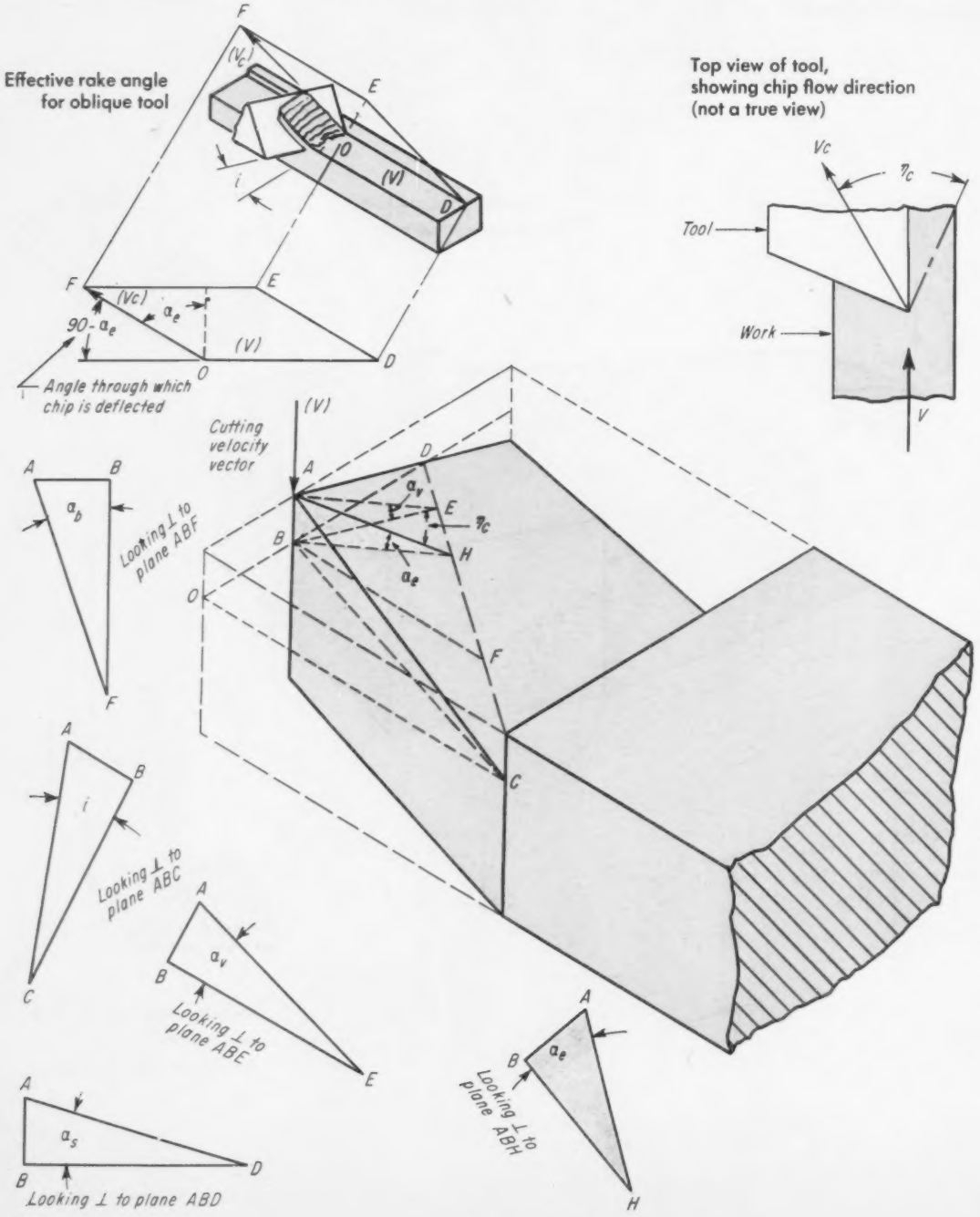
Chip flow angle

To determine the effective rake angle for oblique tools, it is necessary to know the direction in which the chip moves across the tool face. This is specified by the angle η_c, the angle between the chip flow direction and a normal to the cutting edge, as measured in the plane of the tool face. (See sketch of top view.)

According to Stabler's law, the chip flow angle, as a first approximation, is equal to the inclination angle. Actually, it has been found to be as much as 20° larger than the inclination angle, but no better approximation is available.

From similar triangles:

$$\tan \alpha_e = \tan \alpha_s \cos (C_s + i) + \tan \alpha_b \sin (C_s + i)$$


Effective rake angle for oblique tool
Top view of tool, showing chip flow direction (not a true view)
Tool
Work
Angle through which chip is deflected
Cutting velocity vector
Looking ⊥ to plane ABF
Looking ⊥ to plane ABC
Looking ⊥ to plane ABE
Looking ⊥ to plane ABH
Looking ⊥ to plane ABD

Orthogonal and oblique cutting compared

In orthogonal cutting, chip flow direction, when measured in the plane of the tool face, is essentially perpendicular to the cutting edge. In three-dimensional, or oblique, cutting, chip flow direction is inclined to the cutting edge by an angle η_c. See page 102.

And because the orthogonal cutting tool has no inclination, the velocity, normal, and effective rake angles are identical and lie in the same plane.

Summation of formulas

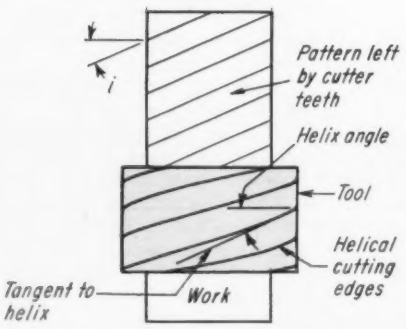
In his book, *Metal Cutting Principles*, Milton C Shaw presents the following formulas for calculating rake angles:

$$\tan i = \tan \alpha_b \cos C_s - \tan \alpha_s \sin C_s$$
$$\tan \alpha_v = \tan \alpha_s \cos C_s + \tan \alpha_b \sin C_s$$
$$\tan \alpha_n = \tan \alpha_v \cos i$$
$$\sin \alpha_e = \sin^2 i + \cos^2 i \sin \alpha_n$$

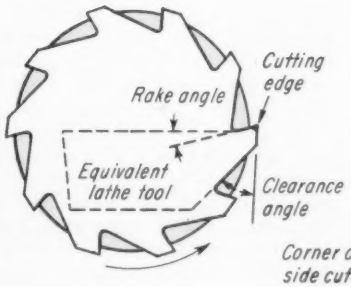
To produce a nomogram that will give us the effective rake angle directly from the tool signature, we have reduced Shaw's formulas to:

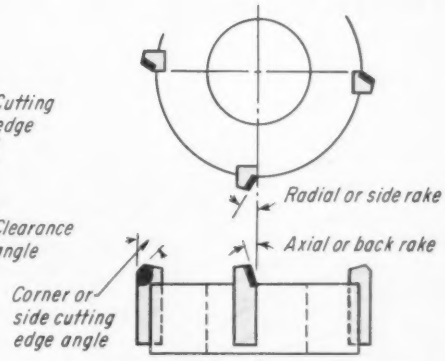
$$\tan \alpha_e = \tan \alpha_s \cos (C_s + i) + \tan \alpha_b \sin (C_s + i)$$

Other types of cutting tools



Plain milling cutter geometry can be related to that of an ordinary lathe tool. See table below





Face milling cutter geometry and equivalent lathe tool angles

This analytical approach can be used for other tools besides lathe tools. The three sketches here, and the accompanying tables, point out the rake angles on a face mill and a plain mill and their equivalents on a lathe tool.

Lathe tool	Face mill
Back rake α_b	Axial rake α_a
Side rake α_s	Radial rake α_r
SCEA C_s	Corner angle CA

The effective rake angle and inclination angle can thus be found for a face mill by changing the names of the face mill angles to the equivalent lathe tool angles.

Lathe tool	Plain mill
Veloc. rake α_v	Radial rake α_r
Incl. angle i	Helix angle

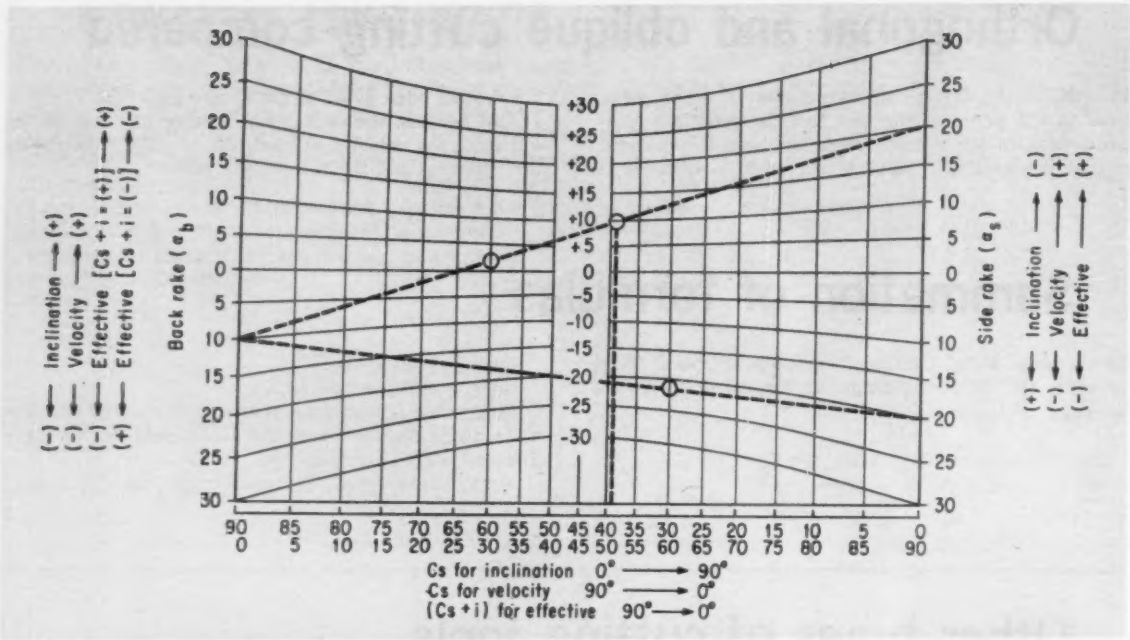
The effective rake angle for a plain mill is found from the nomogram (page 104) or from the formula in the previous section, after the normal rake angle is obtained from:

$$\tan \alpha_n = \tan \alpha_r \cos (\text{helix angle})$$

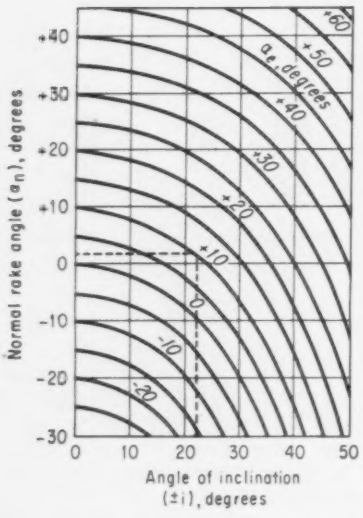
This concludes the analysis of cutting tool geometry, as such. We have defined and derived the inclination angle, velocity rake angle, normal rake angle, and the effective rake angle.

In the following sections, we apply this analysis to specific cutting problems. Our tests will cover milling of M-252 alloy, 17-7PH stainless steel, and Vascojet 1000, and turning of Rene 41, AISI 4340, and HS-25 cobalt-base alloy. We will show how the various angles affect cutting tool performance, that is, tool life, cutting speed, and depth of cut.

But before going into details of the machining tests, we will present two nomograms that simplify determination of the four angles that we have been discussing. The nomograms, developed from the equations presented in the section titled "Summation of Formulas," require no calculations.


Inclination → (+)
Velocity → (+)
Effective [Cs + i = (+)] → (+)
Effective [Cs + i = (-)] → (-)
Back rake (α_b)
Side rake (α_s)
Cs for inclination 0° → 90°
Cs for velocity 90° → 0°
(Cs + i) for effective 90° → 0°

Nomograms for inclination and rake angles



The two nomograms presented in this section will yield, without any calculations, values for the inclination angle, velocity rake, normal rake, and effective rake angles.

The first nomogram (above) is an extended version of Kronenberg's nomogram. It has been modified so effective rake angle, as well as the inclination and velocity rake angle, can be read. The second (left) is from Stabler, and yields the normal rake angle, after we have found the inclination and velocity rake angle from the first nomogram.

The inclination angle is found by connecting a straight line between the back rake angle and the side rake angle on the first nomogram. Inclination angle can then be read on the center vertical scale at a point above the side cutting edge angle C_s.

Velocity rake angle can be found in exactly the same way.

To determine the effective rake angle, use the side cutting edge angle plus inclination angle (C_s + i) as the abscissa. Other than this change, effective rake angle is found in the same way as the previous two angles. Sign convention on scales should be noted carefully.

Examples

Given: $\alpha_b = -10°$, $\alpha_s = 20°$, $C_s = 60°$

To find inclination angle i:

a) Draw line connecting $-10°$ on back rake scale to 20° on side rake scale.
b) From 60° on C_s scale, draw line up until it hits first line.
c) Read i = $-22°$ from curved lines on nomogram.

To find velocity rake angle α_v:

Note: Observe change in sign convention on α_s and C_s scales.

a) Draw line connecting $-10°$ on back rake scale to 20° on side rake scale.
b) From 60° on C_s scale draw line up until it hits first line.
c) Read $\alpha_v = 2°$ from curved lines in nomogram.

To find effective rake angle α_e:

a) Draw line connecting $-10°$ on back rake scale to 20° on side rake scale.
b) Abscissa now becomes C_s + i, or 60° + ($-22°$) = 38°.
c) From 38° on (C_s + i) scale, draw line up until it hits first line.
d) Read α_e = 10° from curved lines on nomogram.

To find normal rake angle α_n:

Note: This angle is found on second nomogram.

a) From $-22°$ on inclination angle scale, draw line upwards.
b) From point where this line crosses 10° on the α_e scale, draw a horizontal line over to α_n scale.
c) Read $\alpha_n = 2°$.

Interpreting the nomograms

The role of the side cutting edge angle C_s in influencing the inclination angle (i) and the velocity rake angle a_v may be seen in the first nomogram. If C_s is zero, the back rake angle becomes the inclination angle (i.e., $a_b = i$), and the side rake angle equals the velocity rake angle (i.e., $a_s = a_v$). The back rake and side cutting edge angle play the leading role in determining the inclination angle, while the side rake is most important in determining the effective rake angle for lathe tools.

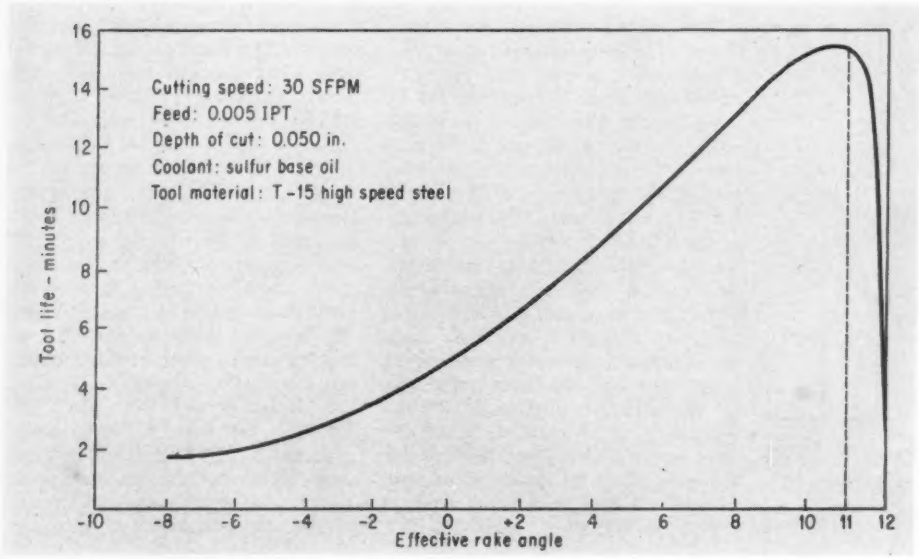
An increase in either the side cutting edge angle or nose radius will bring about an improvement in tool life as well as in surface finish, but only up to a point. Then the tool begins to chatter. It is unfortunate that an increase in cutting edge length also leads to chatter.

The inclination angle determines chip flow direction. A positive inclination angle directs the chip away from the work; a negative angle directs the chip into the work.

Recommended values of rake angle are such that the normal rake angle is smaller the higher the strength of the metal being cut. This decrease in normal rake provides a greater wedge angle at the tool point to support the greater load. Under severe shock conditions, or in machining very hard materials, negative rake carbide-tipped tools are often used.

Determining optimum tool geometry

All of the foregoing analysis was put to use in a series of tests to determine optimum cutting tool geometry for a variety of newer, more-difficult-to-machine alloys —M-252, 17-7PH stainless, Rene 41, Vascojet 1000, AISI 4340, and HS-25. Optimum tool geometry, as discussed in this report, means that particular tool configuration resulting in the greatest metal removal between tool regrinds.



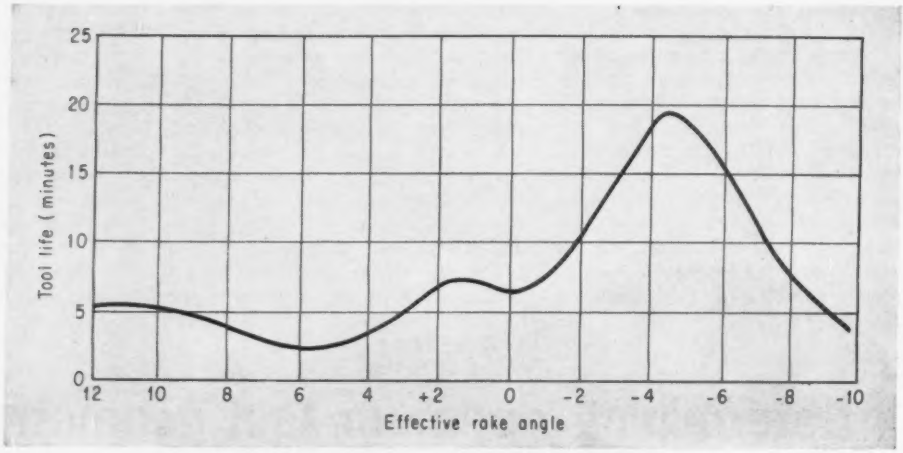
Milling fully aged M-252 alloy

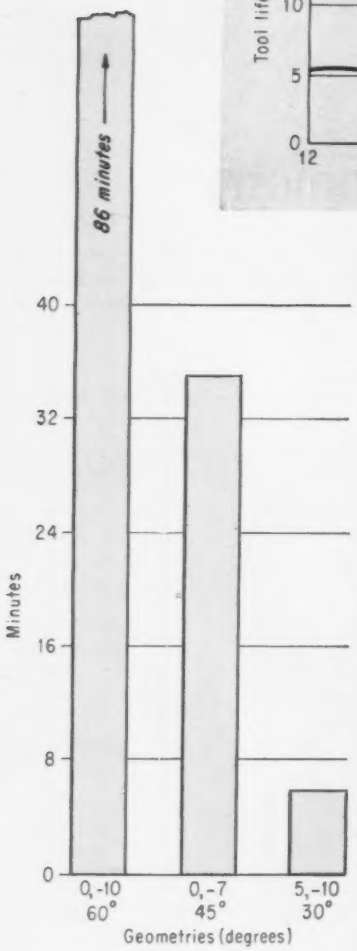
This analytical approach was first used at Chance Vought in an attempt to determine the geometry for a face milling cutter with which to machine fully aged M-252 alloy. All the standard tool geometries had proven unsatisfactory.

Initially, twelve fly-cutter tools of various geometries were prepared and subjected to tool life tests. When the effective rake angles of these tools were computed and plotted against tool life (graph, above), it was apparent that optimum tool life was a function of the effective rake angle as well as of other factors.

From the graph we determined that an effective rake angle of 11° was optimum for face milling M-252. But this was only a partial solution, for, as the nomograms show, there were several combinations of tool angles (over a practical range) that yield an effective rake angle of 11°.

Four such combinations were tested; one gave a tool life 400% greater than the tool we had used to establish the original tool life plot. This tool signature was then designated as optimum for the job.





Face milling 17-7PH stainless

For our tests, the 17-7PH was heat treated to the RH-950 condition, giving it a tensile strength of approximately 218,000 psi and a hardness of Rh 46C.

Ten tool geometries were evaluated and the results plotted on the graph shown above. The optimum effective rake angle was found to be $-4\frac{1}{2}°$. As in the case of the M-252 tests, we then evaluated additional combinations of angles, always maintaining an effective rake of $-4\frac{1}{2}°$.

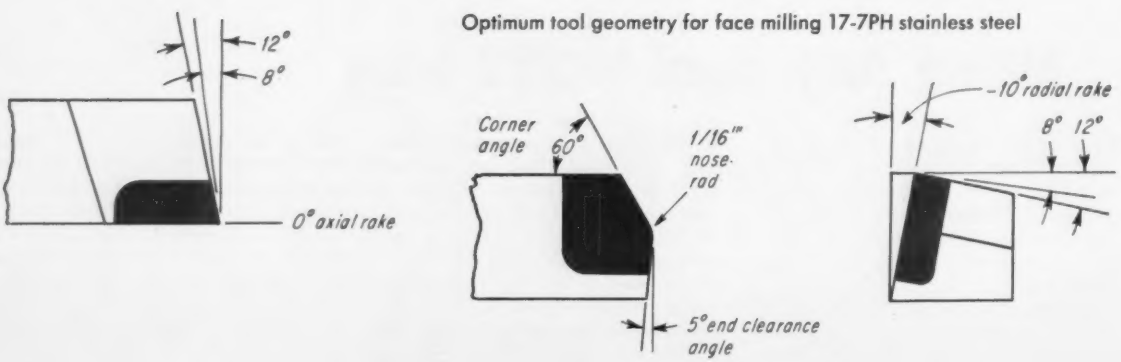
The results of these tests are shown at the left. The tool geometry of each tool tested is specified by three numbers (e.g., 0, −10, 60°); these are, in order, the axial rake, radial rake, and corner angle. These tests show the beneficial effect of a large corner angle. The end clearance angle was 5°; the primary relief angle, 8°; the secondary relief angle, 12°; and the nose radius 1/16 in. The stainless was cut without coolant at 259 sfpm, with a 0.050-in.-deep cut at a feed of 0.0061 ipr. Wear land was 0.015 in.

Obviously, the tool with the 0° axial rake, −10° radial rake, and a 60° corner angle was the best tool tested. This tool is fully described by the sketches below.

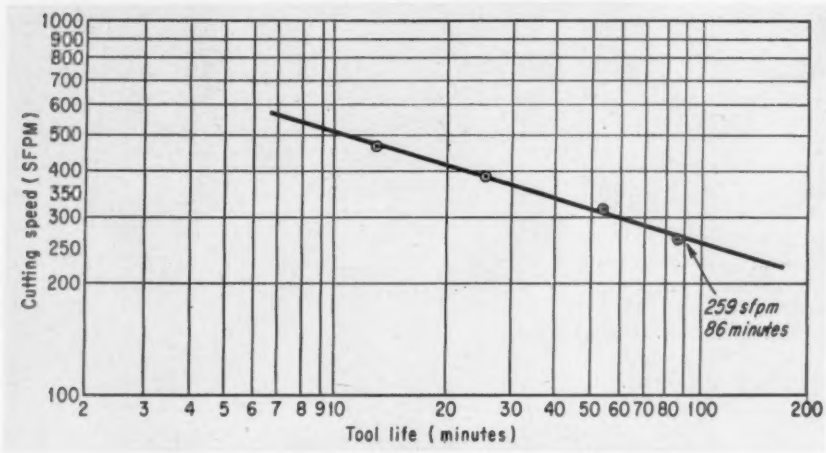
Further tests were then made with this tool and Taylor tool life curves were plotted (right, page 107). The curves, from top to bottom, show the effect of cutting speed, feed rate, and depth of cut on tool life in machining 17-7PH stainless steel with the "best" tool. (This tool geometry and that developed for machining M-252 are not necessarily optimum, but they have proved outstanding.)

No numerical value for the improvement in cutting speed or tool life brought about by this tool geometry can be given at this moment, but the cutting speeds, as shown in the Taylor curves, were considered fantastic for such a high-strength material as 17-7PH. One estimate was that this tool configuration would permit the cutting speed to be increased by a factor of eleven.

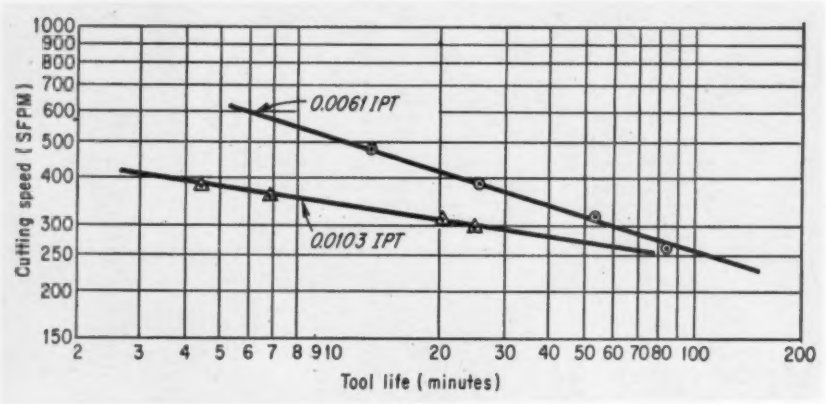
Optimum tool geometry for face milling 17-7PH stainless steel



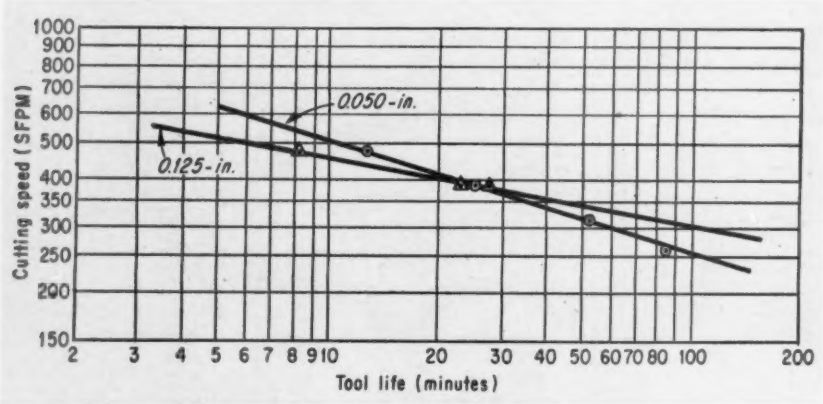
Effect of cutting speed on tool life



Effect of feed rate on tool life



Effect of depth of cut on tool life



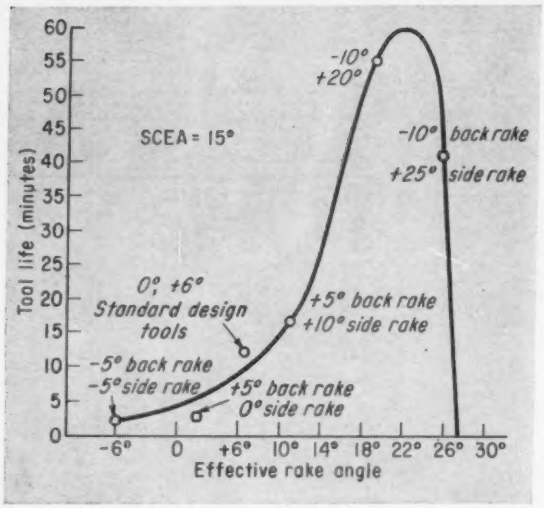
Taylor tool life tests show effect of cutting speed, feed rate, and depth of cut on cutting tool life in machining 17-7PH stainless steel (Rh 46C). The C-2 (Carboloy 883) brazed-carbide tool (No. 10 shank) was of the configuration described at the bottom of the opposite page. Other data: Cutting speed, as noted; wear land, 0.015 in.; no coolant. The feed rate was 0.0062 ipr in the cutting-speed test, as noted in the feed-rate test, and 0.0061 ipr in the depth-of-cut test

Turning aged Rene 41

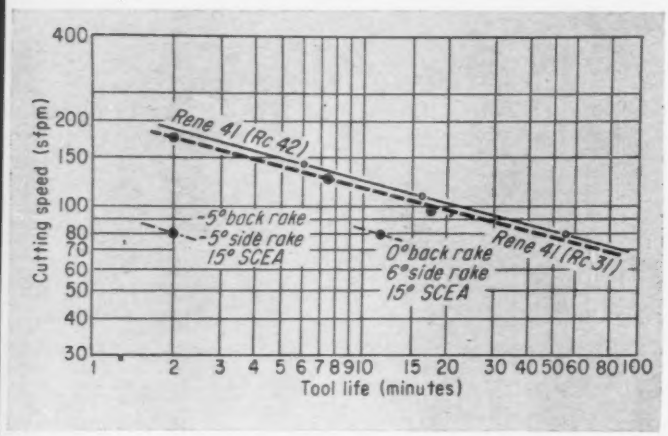
Several tool geometries were evaluated for their effectiveness in turning fully aged Rene 41 (Rh 42C). The results, plotted at the right, illustrate dramatically the impact of tool geometry on cutting efficiency.

The −10° back rake, 20° side rake tool provided a tool life 4.6 and 27.5 times greater than the two most common lathe tool geometries (0° BR, 6° SR; −5° BR, −5° SR). A Taylor tool life plot for this tool is shown below. On the same plot is tool life data for a −10° back rake, 25° side rake tool used to turn Rene 41 that was solution treated but not fully aged.

Prior tests had shown that C-2 grade carbide (Carboloy 883) gave 70% longer tool life than the C-6 grade (Carboloy 370) in machining fully aged Rene 41.



Mat'l: Rene 41 (Rh 42C)
Tool geometry: as noted
Tool mat'l: C-2 carbide
Cutting speed: 80 sfpm
Depth of cut: 0.050 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: Gulf Cut-Aid



Turning Rene 41 (Rh 42C)
Tool signature: −10, 20, 7, 7, 15, 15, 1/16
Tool material: C-2 carbide
Cutting speed: as noted; Depth of cut: 0.050 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: Gulf Cut-aid

Turning Rene 41 (Rh 31C)
Tool signature: −10, 25, 7, 7, 15, 15, 1/16
Other data: same as above

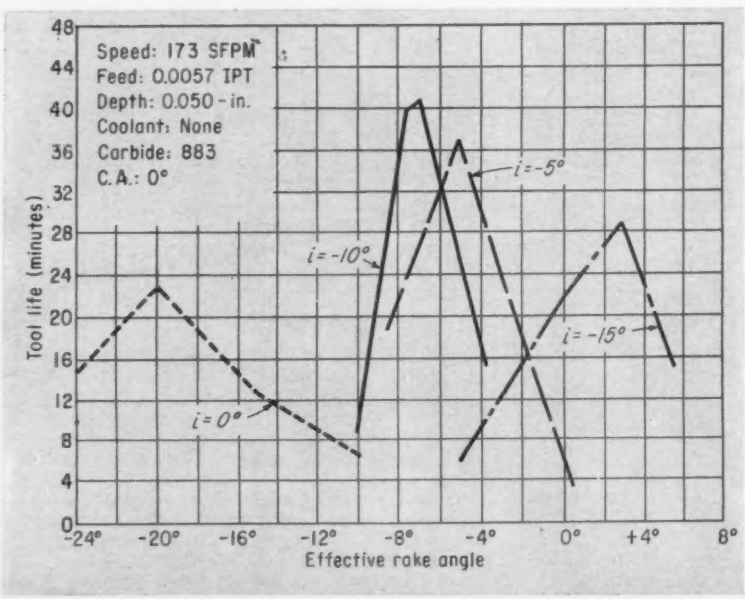
Face milling Vascojet 1000

The previous tests had provided only a partial solution to the problem of determining optimum tool geometry. Optimum effective rake could be found, but this could be obtained through any number of different angles.

Our next step was to run a series of tests holding the inclination angle constant while varying the effective rake angle. A family of such curves for Vascojet 1000 (Rh 56-57C) are plotted at the right.

By determining the optimum inclination angle and the optimum effective rake angle, we can establish the optimum tool geometry from the nomogram (top, page 104).

The −10° axial rake, −9° radial rake, 0° corner angle face milling tool developed in this study gave a 200% increase in tool life, at an increase in speed of 21%, over a standard −5° AR, 0° RR, 0° CA milling cutter.

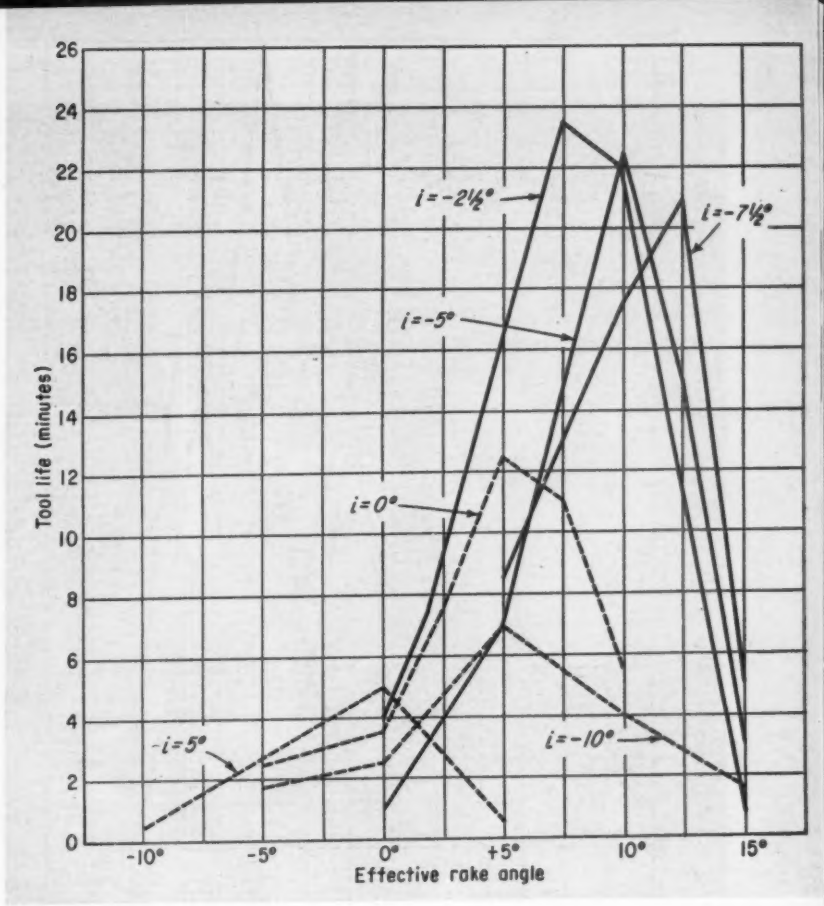


Turning hardened AISI 4340

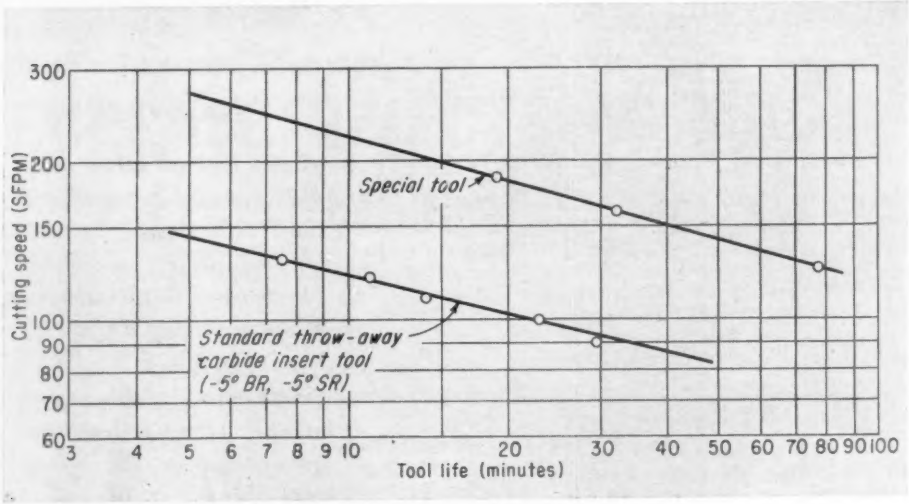
Again holding inclination angle constant while varying the effective rake angle, we ran a series of turning tests on AISI 4340 heat treated to a hardness of Rh 52C. From the results (graph at right) it is clear that the optimum tool geometry consists of an inclination angle of approximately −2½° and an effective rake angle of approximately 7½°.

Using these values in the nomogram (top, page 104), we established a back rake of −1° and a side rake of 8° for a cutting tool with a side cutting edge angle of 15°. The Taylor tool life plot (below) shows that this special tool will allow cutting speeds approximately 75% higher than those attainable with the conventional double negative rake tool.

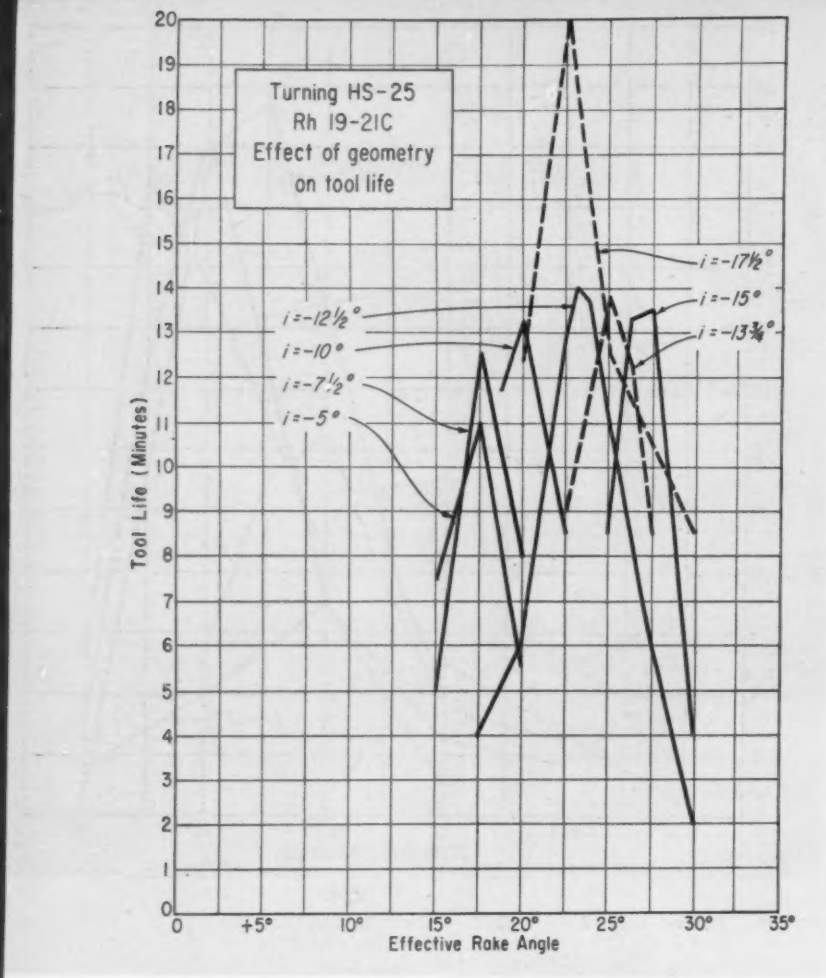
These are laboratory results. Actual shop tests show that a tool with a −5° inclination angle and a 10° effective rake angle is more reliable. That such a tool performs almost as well as our optimum tool can be seen from the graph at the right. For a 15° side cutting edge angle, this tool should have a −2½° back rake and a 10½° side rake.



Turning AISI 4340 (Rh 52C)
Tool mat'l: C-6 carbide
Cutting speed: 175 sfpm
Depth of cut: 0.05 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: none



Turning AISI 4340 (Rh 52C)
Tool signature:
−1, 8, 6, 6, 15, 15, 1/32
Tool material: C-6 carbide
Cutting speed: as noted
Depth of cut: 0.05 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: none



Turning: HS-25 (Rh 19-21C)
Tool mat'l: C-2 carbide
Cutting speed: 200 sfpm
Depth of cut: 0.05 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: Gulf Cut 11-D

Turning HS-25

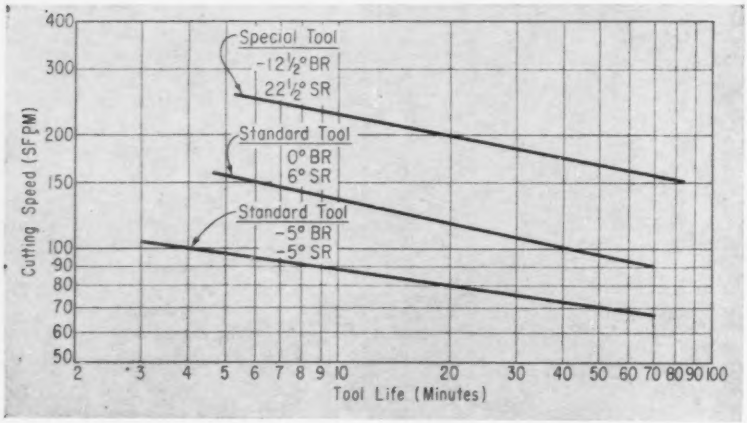
One of our most recent studies involved the turning of Haynes Alloy No. 25 (or HS-25) at a hardness of Rh 19-21C. The tests have not yet been completed, but the results presented here are considered near optimum.

The graph at the left was obtained by holding the inclination angle constant while varying the effective rake angle. Clearly, the optimum inclination angle is −17½° and the optimum effective rake angle is 22½°. For a tool with a side cutting edge angle of 15°, the nomogram tells us that the optimum tool should have a back rake of −12½° and a side rake of 22½°.

Taylor tool life curves (lower left) clearly show the superiority of the optimum tool. At a cutting speed of 150 sfpm, the special tool gives 14 times the tool life of the standard 0° BR, 6° SR turning tool. Further, cutting speeds can be increased some 70% for a given tool life, and surface finish was improved from 90 to 70 microinches RMS.

Turning Inconel X

The latest test involved turning Inconel X (Rh 37C) at a speed of 130 sfpm with a C-2 carbide tool. We took a 0.050-in.-deep cut at a feed of 0.0105 ipr, using Gulf 45-B coolant. Optimum tool signature for a 15° SCEA tool: −0°16′, 17°48′, 8°, 8°, 15°, 15°, 1/32 in. •



Turning HS-25 alloy (Rh 19-21C)
Tool geometry: as noted
Tool mat'l: C-2 carbide
Depth of cut: 0.05 in.
Feed rate: 0.0105 ipr
Wear land: 0.015 in.
Coolant: Gulf Cut 11-D

Reprints

of this and all other AM/MM special reports are available from Reader Service Dept, American Machinist/Metalworking Manufacturing, 330 W 42 St, New York 36, NY. Single copies of this report are 35¢. (Price reduced for quantities over 100.) Other special reports: 16pp, 35¢; 12pp, 30¢; 8pp, 25¢. A list of current reprints is available on request.

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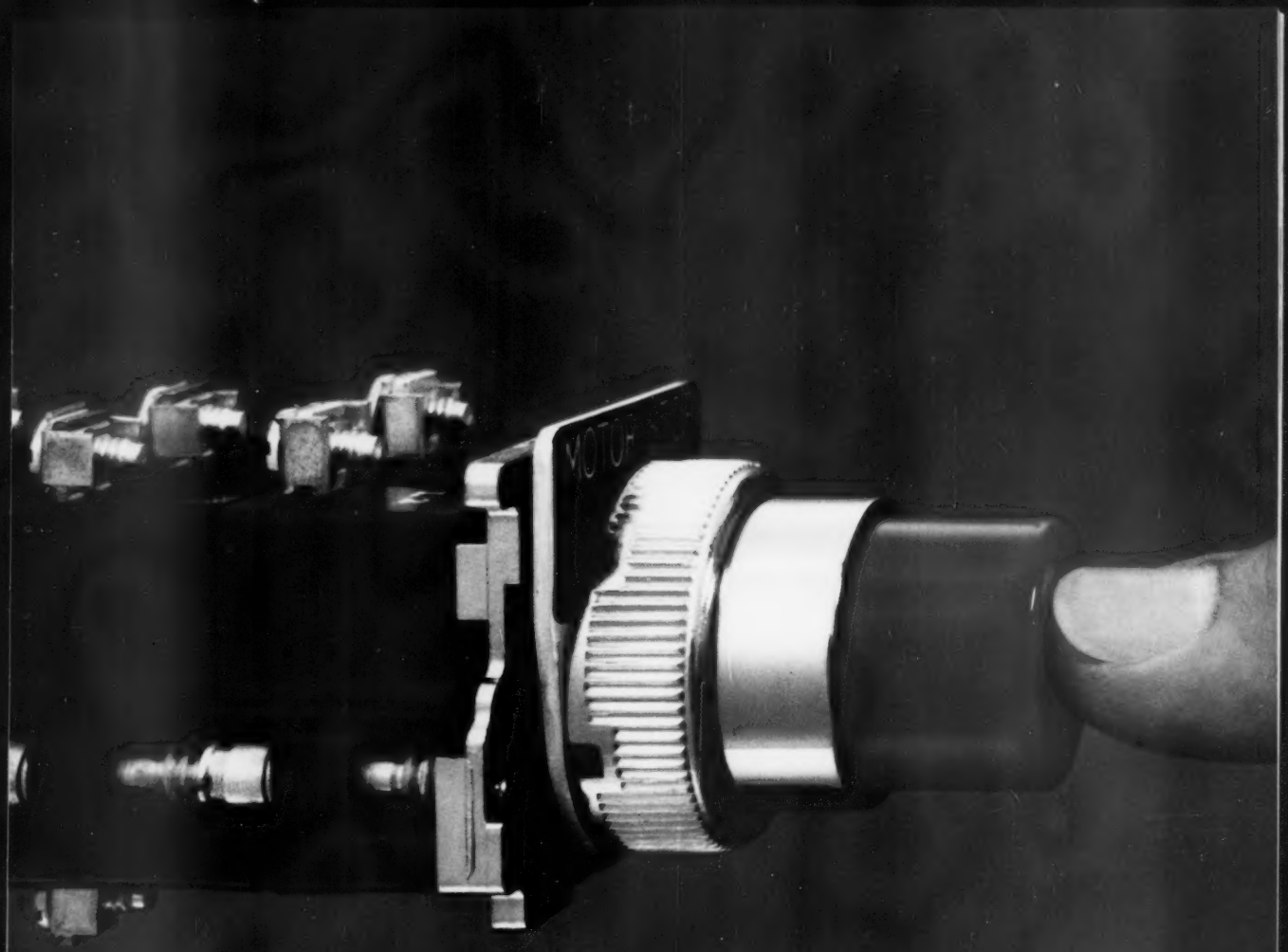

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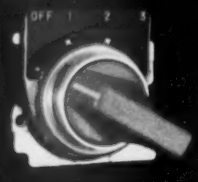

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LONG

ROTO-PUSH

STANDARD

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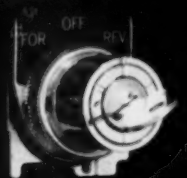

KEY

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GUARDED

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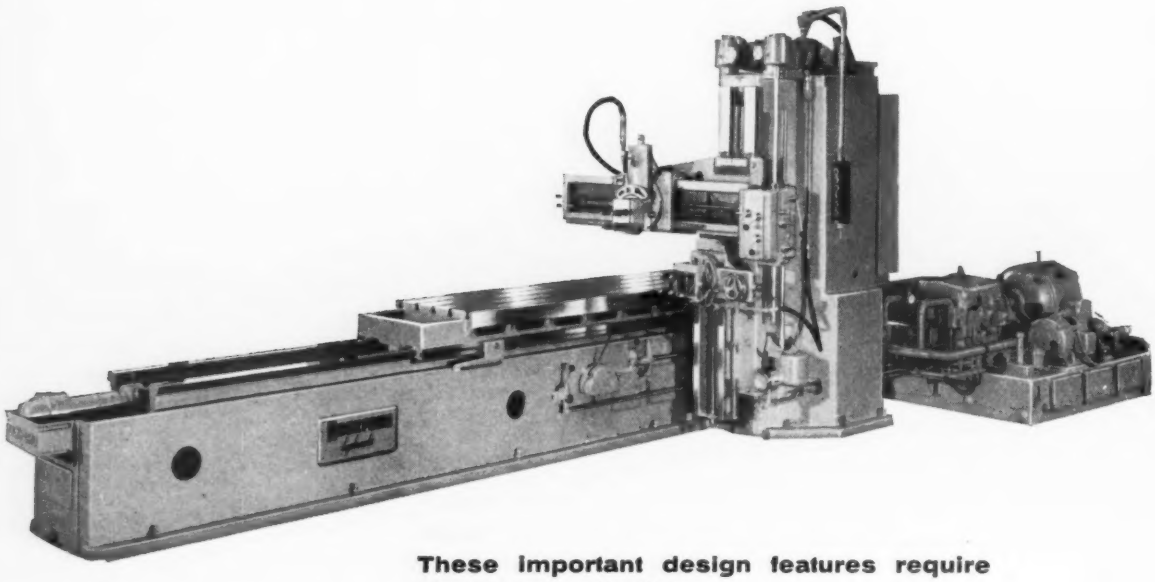
. . . on RMT SHAPER-PLANERS



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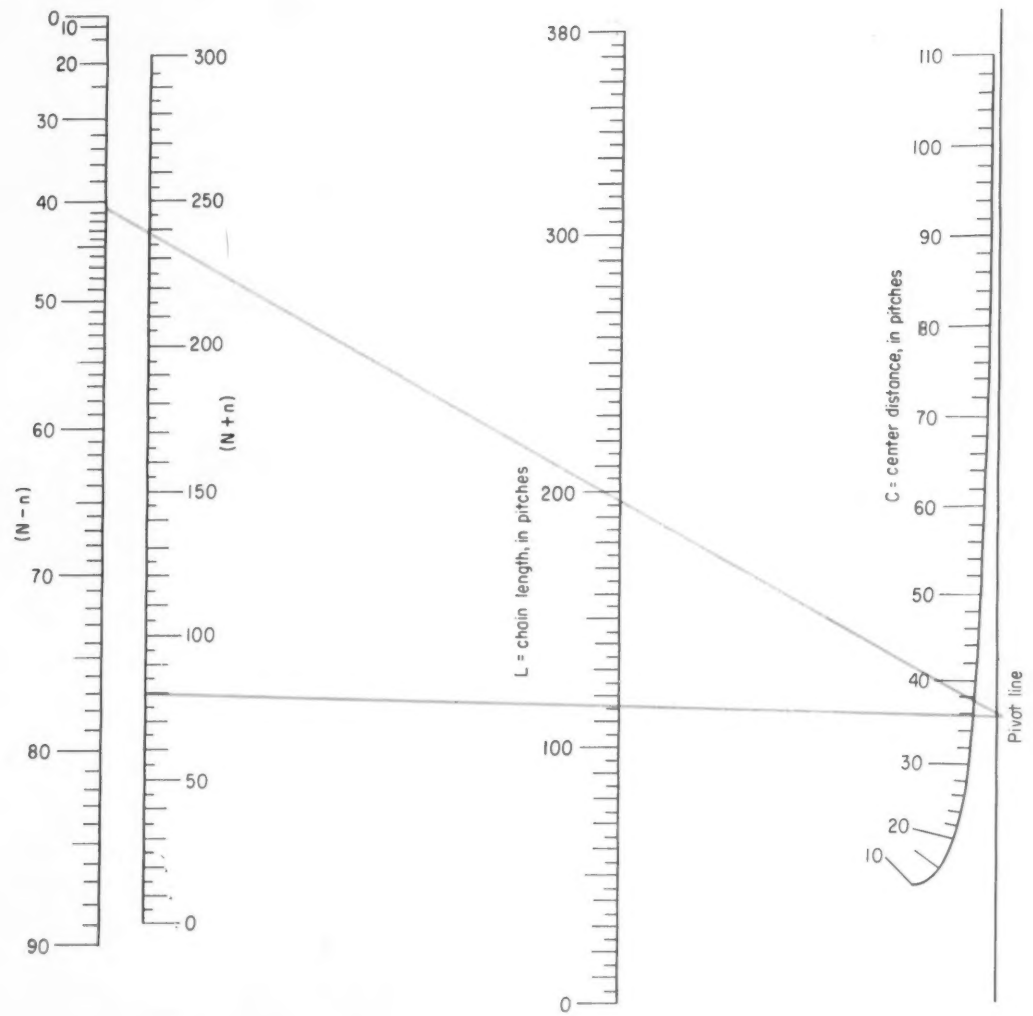
REFERENCE BOOK SHEET

Length and Center Distance of Chains

By F Caplan, Kaiser Engineers, Oakland, California



$$L = 2C + \frac{(N + n)}{2} + \frac{(N - n)^2}{4\pi^2 C}$$

where N = number of teeth in large sprocket
n = number of teeth in small sprocket
C = center distance of sprockets, in pitches
L = chain length in pitches

Example:

$N = 60$, $n = 19$, $C = 38.4$ pitches

Then $N - n = 60 - 19 = 41$

$N + n = 60 + 19 = 79$

Key: (1)...$(N - n)$ to C to a (pivot line)

(2)...a to $(N + n)$

Solution $L = 117.5$ pitches

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Shrink Fits for Stainless Steel

By Ferenc Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, NJ

When making shrink fits in stainless steels (Nos. 302, 303, 321 and 345), it is convenient to have a nomogram that gives the temperature rise required for a given class of fit and the expansion needed for the ring.

Coefficients of expansion α are:

0-200 F – 0.000009
200- 600 F – 0.0000095
600-1000 F – 0.0000101

Diameter of the ring at shrink fit temperature:

$$D_2 = D_1 + \alpha\ (T_2 - T_1)\ D_1$$

when α = coefficient of expansion
T_1 = room temp (68 F)
T_2 = shrink-fit temperature for ring
D_1 = ring dia at 68 F
D_2 = ring dia at T_2

Approximate expansions in terms of ring diameter D, for five classes of fit, are:

Fit	Expansion
FN1	0.00125 D
FN2	0.0025 D
FN3	0.0035 D
FN4	0.0050 D
FN5	0.0085 D

EXAMPLE:

What is the size of a 10-in. ring after heating to shrink fit temperature for a class FN4 fit?

SOLUTION:

On nomogram, connect D = 10 in. with FN4 = 500 F temperature rise. Read expansion N = 0.0475 in.

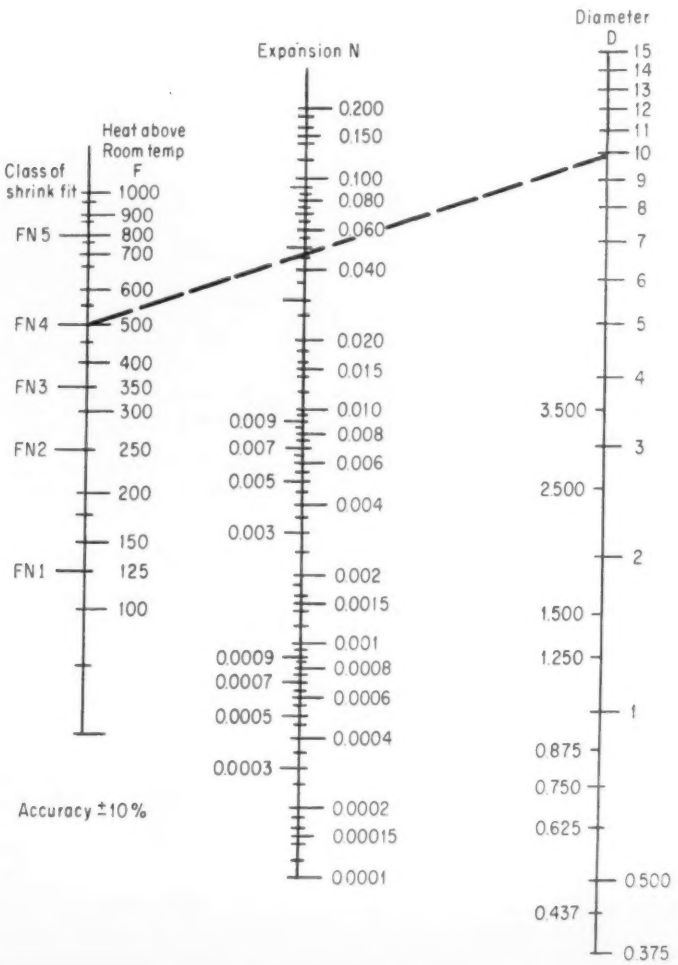
Therefore size of heated ring = 10.0475

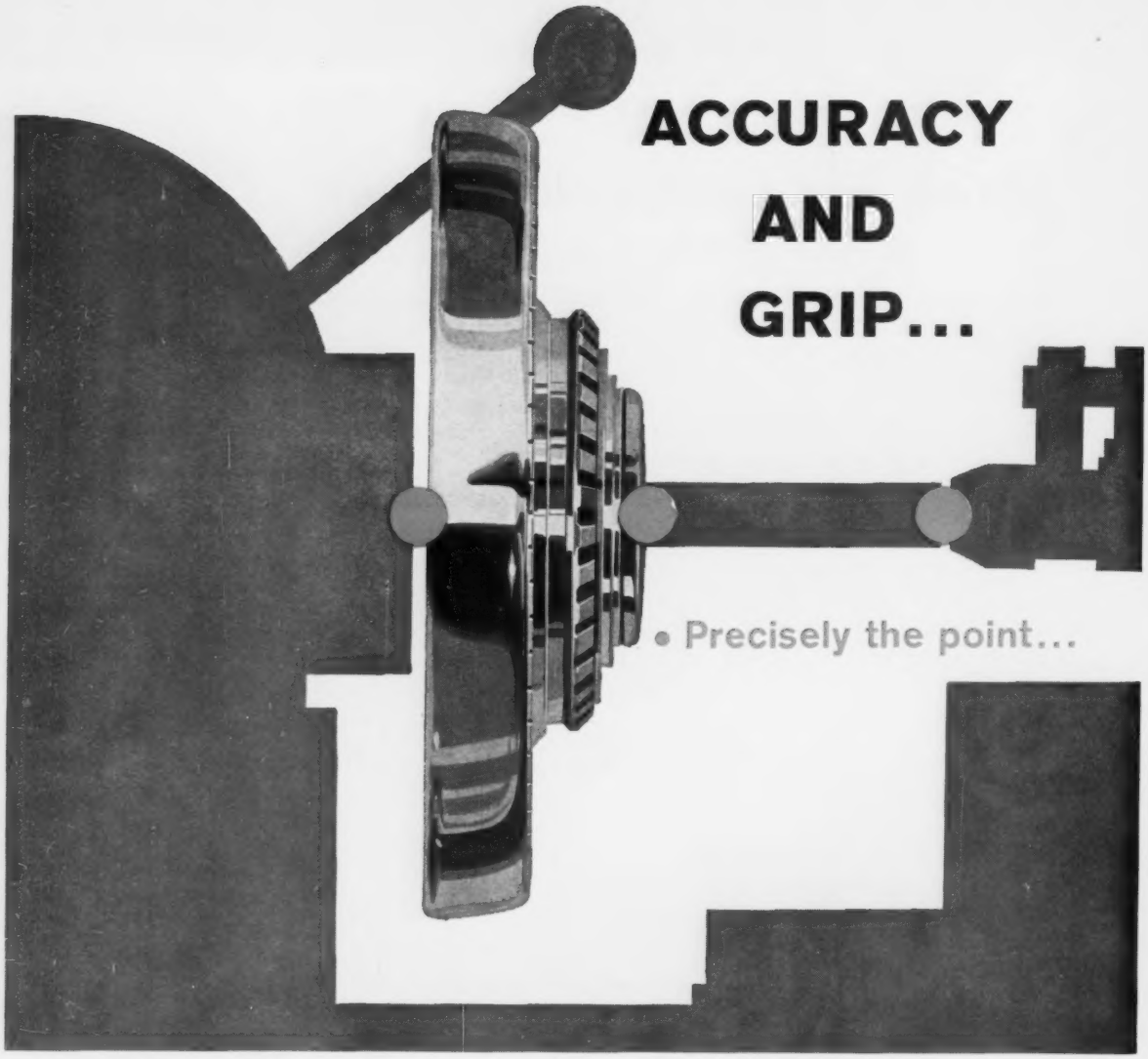
From formula

$D_2 = 10 + 0.0000095\ (568 - 68)\ 10 = 10.0475$

Expansion N = 10.0475 – 10 = 0.0475 in.

The temperature rises given for the several classes of fit are approximate.





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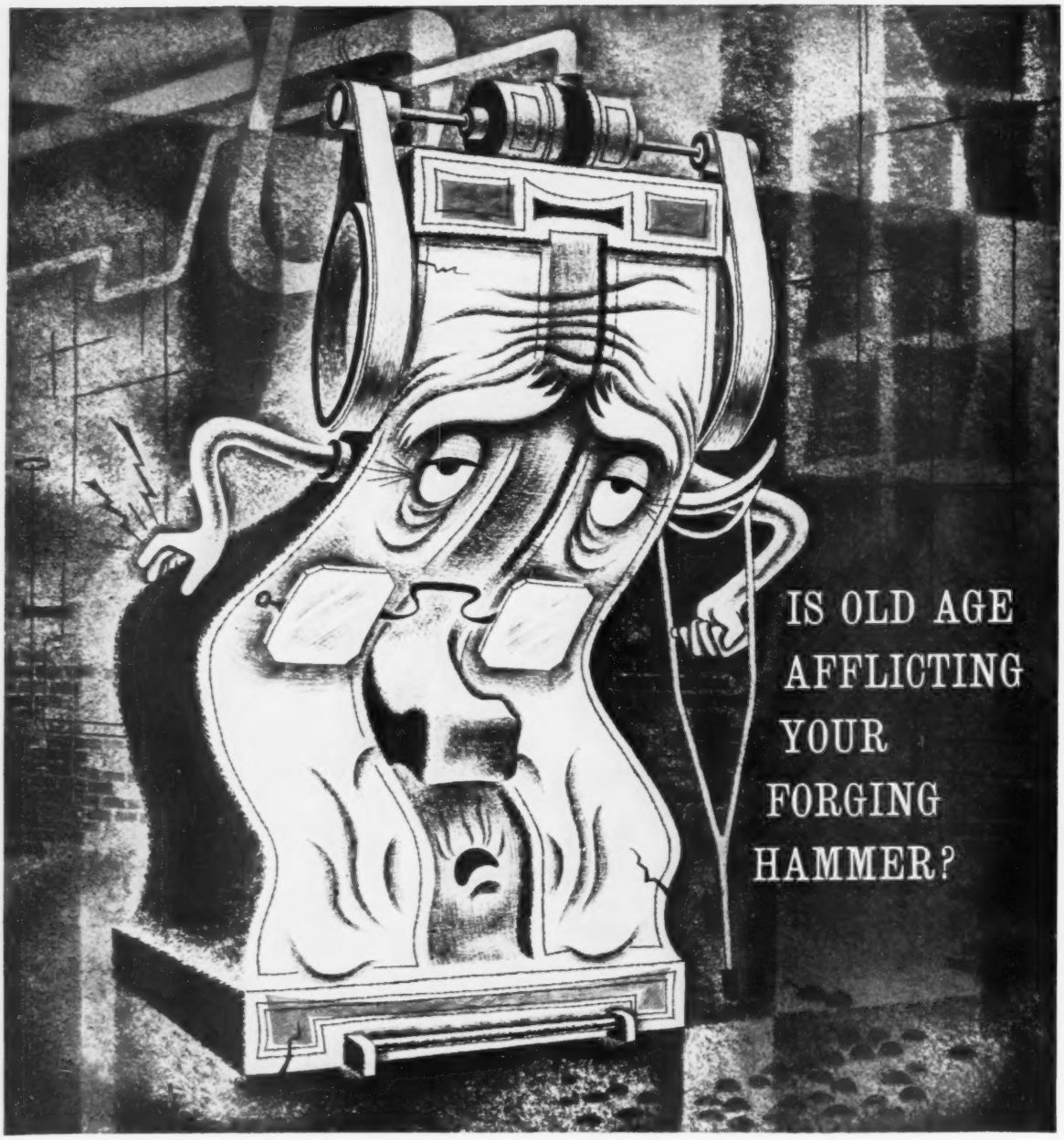

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EF-60-02

Talking Shop

Shortage of Freshmen

ONE PLACE there seems to be a shortage of freshmen is in the engineering schools. The number entering has declined each year starting in 1958. Because total class size has been rising, this means an even sharper drop in the percentage of young men choosing engineering. In 1957 almost 11% of freshmen started in engineering, last fall it had dropped well below 8%.

Missed Anniversaries

SOMEHOW WE FAILED to salute the silver anniversary of Armour Research Foundation and the diamond jubilee (75 years) of seamless steel pipe.

Seamless pipe was produced by the Mannesmann brothers near Duesseldorf, West Germany, in 1866 after a long struggle.

Armour Research started in a few basement rooms in 1936 and handled two research projects, costing $40,000, the first year. Last year the foundation did a research volume that cost $16.5 million.

Ultrasonic Pen

AN ULTRASONIC ball point pen has been developed by Ultrasonics Industries, Inc, Plainview, LI, NY. The pen uses no ink, but makes permanent marks on paper. It is said to work in any position, and through a wide range of temperature and humidity. The pen is expected to find application in strip and chart recorders.

Carbide Shank

A TOLERANCE PROBLEM arose on nylon gear blanks in a printing machinery plant. The thin cutoff tool deflected enough that the parallelism of the faces was not within the ±0.0005 in. on the disks which were 2⅞-in. dia and ¼ in. thick. Extra stock had to be left for a facing operation.

A bar of carbide 6 in. long, ⅛ in. wide, and ½ in. high with a carbide tip brazed on the end was supplied by Kennametal. The rest of the run was completed without a reject.

Cost of Error

COST STUDIES at one automotive plant are said to show that if an engine part is improperly installed the average cost to correct the error in the factory is 2¢. The average cost after the car is delivered to the customer is $100.

Short Thoughts

ALL PROGRESS, says *Miniaturesque*, is based on a universal innate desire on the part of every organism to live beyond its income. When a man figures he's losing his grip, says *Gus of Gisholt*, it's because he never learned to relax when he had it.

On the Recline

A SURVEY OF MATTRESSES has been made by Alfred Politz for American Steel and Wire Div of US steel—which is interested in selling more wire for innersprings. This mattress inventory is not as depressing as the inventory of old machine tools, but it does show that nearly 20% is a lumpy 15 years old. And the discouraging thing is that the old mattress isn't thrown away when a new one is purchased. It is often passed on to someone else—often a growing child.

It may interest you to know that there are more mattresses than people in the US. But not enough to take care of all the in-laws.

Test Short Cut

A WAY HAS BEEN FOUND to test the mechanical properties of foil. The National Bureau of Standards has devised a hydraulic bulge test that measures ductility and yield strength. Foil is a convenient form to use in testing various heat treatments because of the ease with which it can be heated and cooled, but it has been difficult to check for mechanical properties.

In the new method a disk is punched from the foil and clamped in a ring. Oil pressure is applied to one side and the bulge is measured with an optical micrometer.

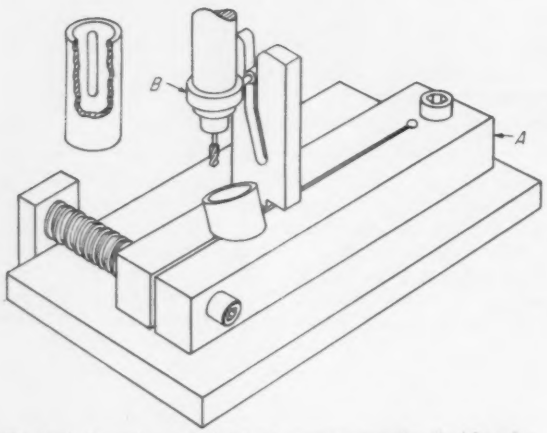
The bulge height at failure is an adequate criterion of ductility. Yield strength is checked by measuring bulge height (after release of pressure) for a series of increasing pressures.

Power of Suggestion

TO STIMULATE employee suggestions, National Cash Register gives a cash award to the employee and a bonus to the winner's wife. This bonus is in the form of merchandise (such as an electric floor polisher) and is in direct proportion to the value of the cash award. •

Practical Ideas

Vertical Mill Cuts Oil Groove



We had to cut a straight oil groove in the inside of a large number of bronze bushings, so we made up this fixture to do the job on a vertical milling machine.

It consists of a baseplate to which a swinging lever *A* is pivoted on a shoulder screw. An angular hole is bored in the top face and has a shoulder to locate the work at the correct depth. The lever is split and has a clamping screw to grip the work. On top of the lever is an upright member in which a cam slot is milled at the same angle as the hole in the lever. A cam follower *B* is clamped to the milling machine quill, and a spring is installed between the lever and a stop block to take out play in the cam.

To use the fixture we swing the lever to the right, clamp a bushing in the hole, and swing the lever back against the spring. The machine spindle is then fed down to engage the follower in the cam slot. As feed is continued, cam action pushes the lever to the left and, as cam slot and bushing have the same angle, the groove depth will be uniform.

The angle of the bushing and cam plate will depend upon the diameter and length of the bushing and can easily be established by a layout.

H Koslow, Bronx, NY

Fixture Permits Leadscrew Tapping

When accurately tapped threads are required and a leadscrew tapper is not available, either straight or pipe threads can be produced to a high degree of precision on an ordinary single-spindle drillpress by means of this leadscrew tapping fixture.

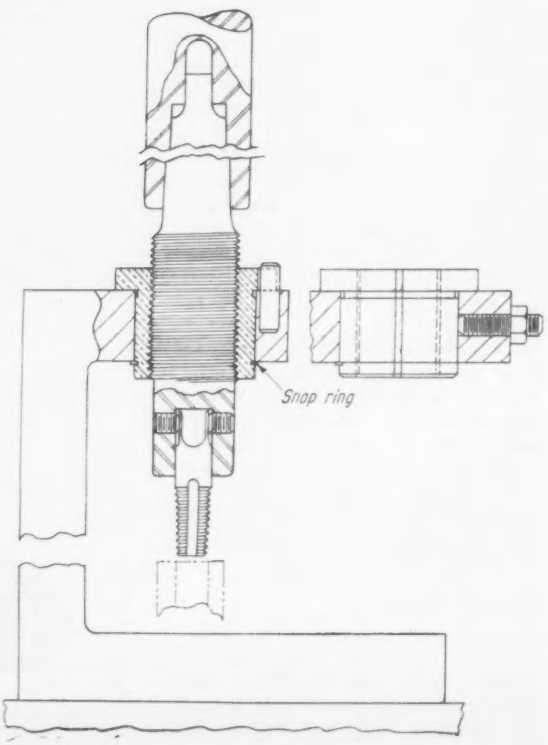
The lower arm of the fixture body is machined on the bottom to lie flat on the machine table, and its upper face is machined parallel to the base so the work will sit true. The upper arm is bored to a slip fit for the threaded bushing. The bushing is tapped to the same pitch as the tap to be used and is prevented from rotating by a stop pin. A snap ring prevents it from pulling out when the spindle is reversed. Compensation for wear is provided by splitting the bushing down one side and squeezing it with an adjusting screw retained by a locknut.

The tap holder has a taper shank to suit the drillpress, and a straight, threaded portion to engage the bushing. If possible, the threads should be ground. The lower end of the holder is bored a snug fit for the shank of the tap, and two headless setscrews are provided to lock the tap in place.

The fixture may be used for a wide variety of jobs by using holders and bushings with thread pitches to suit the jobs to be done. Changeover from one size to another takes only a few minutes.

The drillpress must, of course, have a reversible motor for operation by manual pushbuttons, or it can be made fully automatic by incorporating two precision limit switches and adjustable trip dogs.

Richard Prince, Sioux City, Iowa

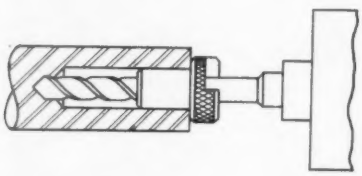


Bushing in Work Aligns Drill

A standard knurled-head slip bushing can often be used to help maintain alignment of drills when drilling stepped holes in a turret lathe. After the first, larger, hole is drilled, the bushing is slipped into it to guide the second, smaller, drill. This will produce much better concentricity than relying on the second drill to align itself with the conical bottom of the first hole.

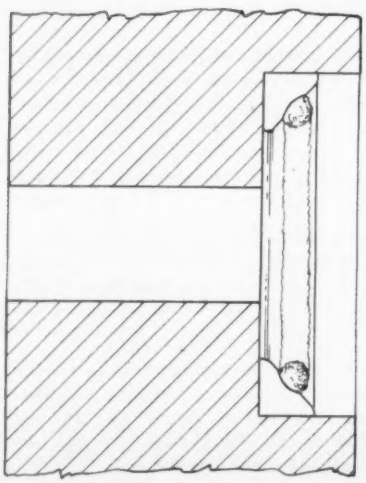
Jig bushings are available for all standard drill sizes, but in only a limited number of OD's. However it is a simple matter to put one of the nearest available size on a mandrel and grind the OD to the required hole size.

H J Gerber, Stillwater, Okla



Weld Bead Removes Bearing Race

When ball or roller bearing races have been pressed into a counterbore it is well nigh impossible to remove them with any kind of a puller. However, we have found that by using an arc welder to run a bead of metal around the ID of the race, this will shrink enough to allow it to fall out. Sometimes, particularly on large-diameter races, they loosen up but will not fall out. In such cases we just weld on two arc rods, 180° apart and use these as pullers to wiggle the race out.



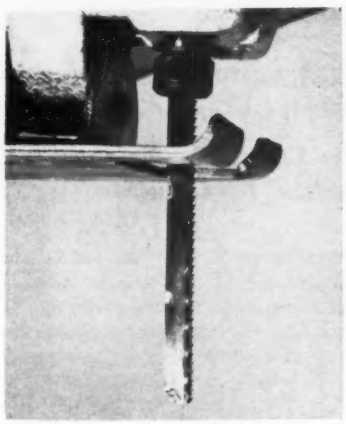
The method works so well that it is standard practice in our shop for all bearing removals, and we no longer have to worry about damaging a piece of machinery with a punch or puller.

R B Courtney, Whittier, Calif

Fine-Tooth Sabre Saw Blades Are Made in Shop

We use a sabre saw in our shop for cutting light-gage sheet metal and it often happens that we run out of fine-tooth blades. To meet this emergency we take two pieces of 14-tooth bandsaw blade, stagger the teeth, and spotweld them together in three places. Blades made this way cost only about one-tenth of the cost of regular sabre saw blades, and we have found that they last quite as long.

Robert Micals, Freehold, NJ

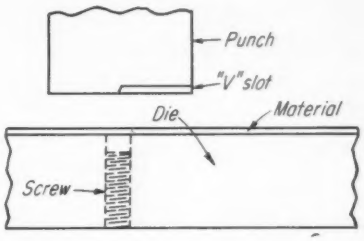


Slot Relieves Punch Pressure

When stamping thin material, if the punch happens to come over a dowel or screw hole, the hydraulic pressure set up by the lubricant on the metal will extrude the material into a little mound or bubble. Such bumps are almost impossible to iron out because the metal has been stretched.

A solution to this problem is to grind a Vee groove across the opposing surface of the punch or die. It need be only about 0.002 in. deep but will be sufficient to allow the oil to escape, yet not enough to mark the surface of the work.

B Schneider, W Orange, NJ



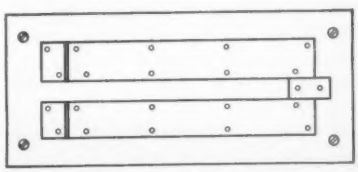
Guide Helps Cut Rubber

We had to cut a lot of strips of soft, half-inch-square rubber into several different lengths to serve as waterproof seals for box covers. It was difficult to keep the lengths uniform and the ends square for butt joints, so we made up this jig to solve the problem.

The base is a piece of plywood screwed to the bench, and on it are nailed two wooden guide strips. At one end is a wooden block to act as an end stop. This is held by a couple of nails that are driven only partly into the base, so the block can be shifted easily to suit different lengths. Near the other end is a guide slot for the cutter blade.

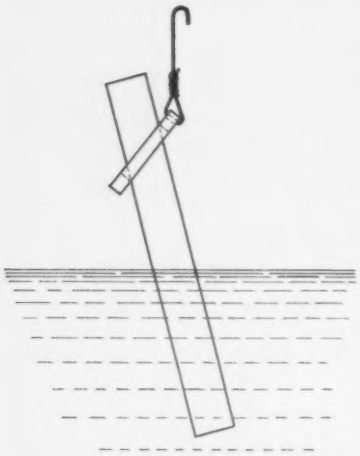
Instead of using an ordinary knife, which is hard on the hands, we ground the teeth off a hacksaw blade, sharpened it to a razor edge, and used it in a regular hacksaw frame. To prevent the blade from sticking and distorting the rubber, we lubricated it with kerosene. We have also used the same setup for cutting rubber and plastic tubing.

Fred Lettino, L I City, NY



Practical Ideas

Washer Supports Work



We had to plate a large number of rods for approximately half their length and wanted to avoid the time and expense of applying conventional stopoff materials which would, later, have to be removed. We tried wrapping a wire around them, but this took quite some time and, quite frequently, the wire would slip. Then we hit on this idea: we took some plain washers and drilled a hole through one side for the supporting wire and slipped them over the rods. The weight of the rod tends to make the washer grip on opposite sides, so the work cannot slip down.

The same idea can also be used for hanging up barstock in the stockroom. Bars can be removed by taking the weight and straightening the washer. The principle is not new, but its safety may be judged by the fact that it has been used on automobile jacks.

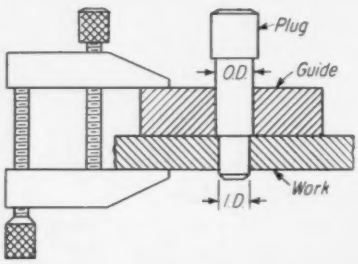
H F Spinks, W Croydon, England

Guide Stops Tap Breakage

Misalignment of the tap with the drilled hole is one of the greatest causes of tap breakage. This can often be avoided by clamping a guide block to the work, having a hole drilled in it the same size as the OD of the tap. To insure perfect alignment, make a two-diameter plug to enter the two holes before clamping.

If it is not practicable to use a separate guide, the tap-drilled hole may be opened up for part of its length with a drill of the same diameter as the OD of the tap. As long as the length of the thread is equal to one diameter, the strength of the connection will be adequate. In the case of a blind hole, the depth of the tap-drilled hole below the body-drilled hole should be one diameter plus ⅛ in.

P Dryere, Col Campestre, Mexico



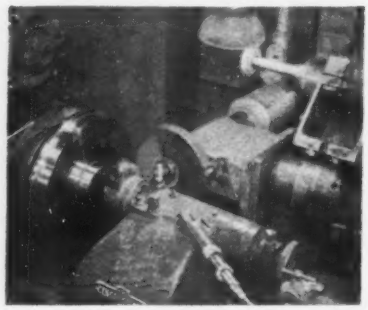
Fixture Permits Surface Grinding Between Centers

The piece shown in the illustration is 12 in. in dia, ground all over, and all surfaces must be held within a runout of 0.0001 in. In order to hold this close tolerance and obtain a fine surface finish, we did all the grinding between centers on a Cincinnati hydraulic grinder. But surface grinding the 4-in. wide flange to obtain a perfectly flat surface presented a considerable problem.

We solved it by making up a fixture to fit the wheelhead of the Cincinnati, incorporating a riser from a Taft-Peirce grinder. This allowed us to use a Taft-Peirce spindle and surface grind the flat face with the work between centers.

On the opposite side there is a ball bearing race which we also grind between centers by using the regular internal grinding attachment and swiveling the wheelhead to a 10° angle.

Ben Leckler, St Louis, Mo



MULTIPLE DRILL JIG HAS SEMI-AUTOMATIC UNLOADER

Was the winning entry in the July 10, 1961 issue.

The $25 prize is awarded to:
Hjalmar Dahl, Upplands Vasby, Sweden

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

PAYMENT—will be made as soon as tabulation is completed, and is in addition to the regular rate for the item published.

JUDGES—are a group of American Machinist/Metalworking Manufacturing readers who select articles they prefer in a particular issue. The group changes entirely with each issue and thus represents a true cross-section of readers. Their decision is accepted by the editors, without reservation or bias, as final in each case.

REQUIREMENTS—Items must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with AM/MM standards, and readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Names in the News

Sibley Machine & Foundry Corp, South Bend, Ind, has named **John E McIntyre** president to succeed **Bernard J Voll** who has been named board chairman. Mr McIntyre was formerly vice president and general manager. **William H Voll,** sales manager, has been appointed vice president, sales

Hanson-Van Winkle-Munning Co, Matawan, NJ, has appointed **Fredrick A Pitschke** sales manager of the Electrochemical Machining Division. He was formerly sales manager, electrical discharge machining department, of Sundstrand Corp and headed the company's numerical control section

Hyster Co, Portland, Ore, has elected **Philip S Hill** president. Formerly executive vice president, he succeeds **Ernest G Swigert,** now board chairman and chief executive officer

Federal-Mogul-Bower Bearings Inc, Detroit, has named **John E Brennan** a vice president of the corporation and general manager of the International Division. Mr Brennan resigned in July from the post of vice president of Chrysler Corp and director of manufacturing staff and services.

Lockheed Aircraft Corp, Burbank, Calif, has elected **Courtlandt S Gross** chairman of the board and **Daniel J Haughton** president of the organization. Mr Gross, president for the past five years, succeeds his brother, the late **Robert E Gross.** Mr Haughton was formerly executive vice president.

Stanley Works, New Britain, Conn, has elected **Donald W Davis** a vice president. He continues as general manager of the Stanley Steel Strapping Division.

Chevrolet Motor Division has appointed **Lloyd J Bentley** general superintendent of production at the engine plant in Buffalo. Mr Bentley, who has been a production superintendent at the Gear & Axle plant in Detroit, succeeds **James W McLernon,** recently appointed assistant manager of the company's manufacturing research and development department in Detroit.

Watts Regulator Co, Lawrence, Mass, has named **John S Colter** manager of its Industrial Division which manufactures pneumatic specialties and related industrial products. He was formerly associated with the Foxboro Co.

Verson Allsteel Press Co, Chicago, has named **John Powers** (left) vice president, operations. **Henry De Matteo** has been appointed manufacturing and works manager. Mr Powers was formerly manufacturing manager and Mr De Matteo works manager

Butterfield Division of **Union Twist Drill Co** has appointed **Laurence D Gillane** district manager of the middle Atlantic area. District headquarters are in Englewood, NJ.

Black & Webster Sales Inc, Watertown, Mass, has named **Donald B White** manager of the Hydraulic Division.

American Machine & Foundry Co has elected **James E Duff** vice president in charge of marketing at **Cuno Engineering Corp,** Meriden, Conn, subsidiary. He was formerly general sales manager of Joy Manufacturing Co's Electrical Products Division.

Tuthill Pump Co, Chicago, has named **Orville G Mahnensmith** sales manager of the Fill-Rite Division. He was formerly sales manager of the Ossian Engineering Co, assets of which were acquired by Tuthill on June 1.

Aeroquip Corp, Jackson, Mich, has named **Kent R Manning,** a vice president, to head the newly formed Aircraft Division which will include all of the company's aircraft products manufacturing and marketing activities in the US except for those of the Marman Division in Los Angeles. **John M Van Dam,** previously vice president and general manager of the Western Plant (formerly the Western Division) has been appointed vice president and general manager of the Marman Division. **William F Rogge,** an Aeroquip vice president, has been named to head

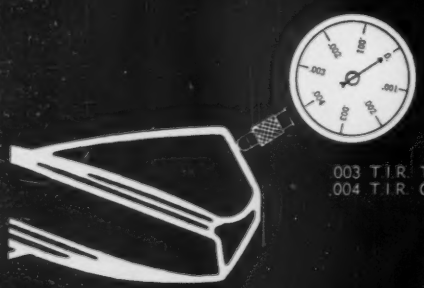
(continued on p170)

MOHAWK PRECISION MADE

Double and Triple Margin Drills

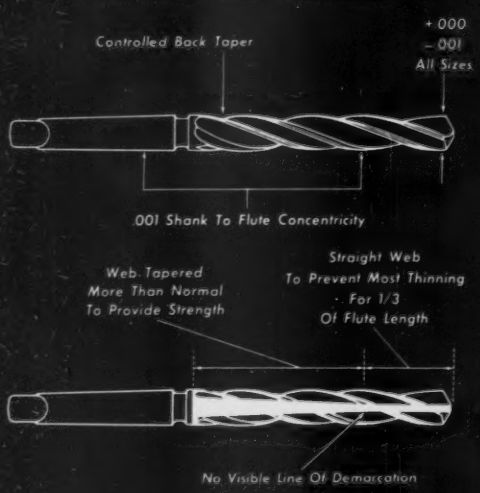
In Stock!

Available in TAPER SHANK and JOBBERS LENGTH, FRACTIONAL and LETTER SIZES



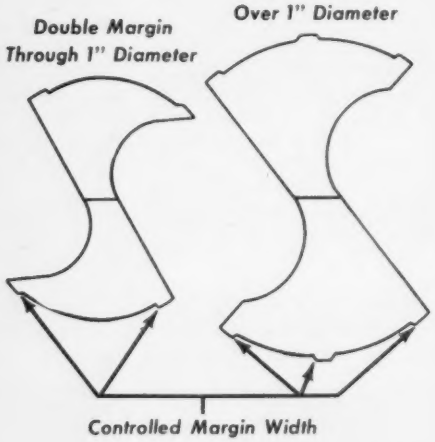
.003 T.I.R. Through 1½"
.004 T.I.R. Over 1½"

GUARANTEED DRILL POINT ACCURACY



Surface Treated, 118° Point

ALL PRECISION MADE DRILLS are milled and ground BETWEEN CENTERS to ASSURE ACCURACY



Send for your copy of the new PM Brochure

Armco Steel for Severe Cold Heading Sells for Price of Type 305 Stainless

Designated Armco 18-9 LW, a new low work-hardening stainless steel alloy has fabricating properties and corrosion resistance similar to that of Armco 16-18 stainless and other high-nickel alloys. However, the 18-9 LY is priced at 47¢ per pound base (price of company's Type 305 stainless). This is more than 13¢ lower than the 16-18, currently priced at 60.25¢ per pound base.

The rate of cold work-hardening for the 18-9 LW is markedly less than that of the conventional 305 cold heading material. In fact, the new material compares very favorably with the 16 Cr-18 Ni alloy, which has the lowest cold work-hardening rate of any of the austenitic chromium-nickel alloys.

As a part of the company's development program, 18-9 LW cold heading wire was used by a large midwestern fastener manufacturer for more than a year. Fastener applications formerly requiring high-nickel alloys to satisfy severe cold forming requirements were switched successfully to the new material, according to the manufacturer. Standard cold heading practices were used.

In tests involving pointing, roll threading, and knurling operations, the material performed equally as well as the high-nickel alloy, Armco reports. In addition, the new material is said to have proved superior in cutoff and slotting operations.

According to company reports, the machining characteristics of 18-9 LW are superior to those of Type 304, and machinability approaches that of the free-machining grades. Corrosion resistance is reported similar to that of Armco 16-18 and Type 305 when exposed to salt spray fog, tap water, humidity tests, and marine atmospheres.

Nominal composition is: C, 0.10 max; Mn, 2.00 max; P, 0.045 max; S, 0.030 max; Si, 1.00 max; Cr, 17.00 to 19.00; Ni, 8.00 to 10.00; Cu, 3.00 to 4.00. The material is available in billets, hot and cold finished bars, hot rolled rods, and cold drawn wire.

Armco Steel Corp, Middletown, Ohio

MORE DATA? Circle 78, inside back cover

Allied Research Introduces Single Dip Cadmium Brightener

A single dip that will produce a bright clear finish on cadmium barrel plated work or rack plated work, Iridite No. 4L-1 will stand transfer times of 3 to 40 seconds without cloudiness or staining.

The easy rinsing dip is said to give excellent corrosion protection and to permit easy soldering after long periods of storage.

Allied Research Products, Inc, 4004 E Monument St, Baltimore, Md

MORE DATA? Circle 79, inside back cover

Flux Gives Strong Joints In Aluminum With Ordinary Solders

Aluminum can be soldered with ordinary soft solders by using LA-CO aluminum flux. Secret of the flux's ability to make strong joints with ordinary solder is said to be its unusual cleaning action. It reportedly penetrates into small crevices by capillary action and cleans the surface so that preliminary sanding, wire-brushing, and scraping of joints is unnecessary. The flux is available in paste form packed in 4-oz and 1-lb tins. Larger volumes are also available for production use.

Lake Chemical Co, 3052 W Carroll Ave, Chicago 12, Ill

MORE DATA? Circle 80, inside back cover

Four Grades of Flame-Retardant Laminates Introduced by Synthane

Four laminates for printed circuit board and other electronic component manufacture, are all flame retardant.

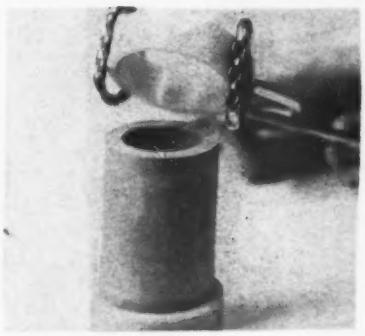
Grade FR-1 is a paper base phenolic and is self extinguishing. Grade FR-2, the newest of the flame retardant laminates, is a paper-base laminate with phenolic resin binder. It may be punched at room temperatures, is self extinguishing, and is said to possess unusual arc resistance.

FR-3, an Alpha paper-base laminate with epoxy resin binder, is recommended for printed circuits that require a high bond strength and resistance to fungus attack. It is also suitable for applications where electrical properties must remain stable over a wide range of temperature and humidity changes.

FR-4 is a glass base epoxy laminate with good dielectric loss and dielectric breakdown values under both dry and humid conditions.

Synthane Corp, Oaks, Pa

MORE DATA, Circle 81, inside back cover



Westinghouse Dacron-Epoxy Tubing Makes Shrink-Fitted Slip Rings

New HY-418 heat-shrinkable Dacron-epoxy tubing gives simple and precise slip ring positioning and eliminates machining operations for press-fitted slip rings. Also unnecessary with rings made of the new tubing is splitting and bonding the rings when fitting.

Typical shrinkage on a 1-in ID piece of tubing is 0.030 to 0.050 in. when heated to 150 C for 10 min and allowed to cool to room temperature. Tensile strength of the tubing is 8500 psi, compressive strength is 17,200 psi, water absorption is 0.18% and dielectric strength is 407 volts per mil.

The tubing is supplied in ¼ to 48 in. ID, 1/16 to 1-in. wall thickness and 36-in. maximum length.

Westinghouse Electric Corp, Hampton, S C

MORE DATA? Circle 82, inside back cover

"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

Here's why Lufkin's indicator is the most sensitive!"

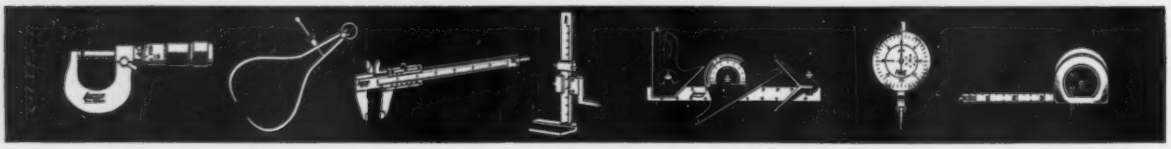
It is made with the precision of a fine watch, with jeweled bearings for longer life.

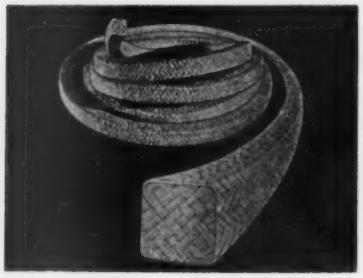
Lufkin's V32 Dial Test Indicator has a 180° contact point swivel. The dial has clear, easy-to-read graduations to .0001". . . and a switch lever for full reverse action.

Exclusive ball-bearing mounting reduces friction, assures greater accuracy—an excellent example of how Lufkin leads in precision-tool design.

Mount the V32 on a Lufkin Miti-Mite Holder with its rigid (5/16") center post and you have a vertical testing setup that will stay firmly in place. (There's a permanent magnet in the base with a 50-lb. pull.)

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. See him for prompt and reliable service. LUFKIN, Saginaw, Mich.





Teflon Impregnated Asbestos Packing Withstands High Heat

Lattuce braid Teflon packings are recommended for centrifugal and rotary shafts, valve stems, expansion joints, reciprocating rods, plungers and rams.

Style 5881 is specifically designed for strong caustics, nitric and sulfuric acid, alcohol, lime solutions, waxes, chlorine, and film coating solvents. Style 5875 is suitable for use with gasoline, cold and hot oils and water. Both types will withstand temperatures in the range from –90 to +500 F.

The Teflon-impregnated asbestos packings are available in reel or spool form from ¼ to 1 in. square.

Garlock Inc, Palmyra, NY

MORE DATA? Circle 83, inside back cover

Water-Glycol Hydraulic Fluid Resists Fire, Cavitation

New fire-resistant water-glycol hydraulic fluid is high in water content (35 to 50%) but is said to possess a higher viscosity index than other water-glycol fluids. This high viscosity index, combined with a low pour point, reportedly minimizes cavitation during cold weather start-up, resists chemical shearing action, and gives excellent hydraulic efficiency.

Developed to provide non-flammability and improved corrosion control in hydraulic systems, the fluid, called Frye-Safe 225, is also said to have excellent heat transfer and high conductivity.

Nalco Chemical Co, 6216 W 66th Place, Chicago 38, Ill

MORE DATA? Circle 84, inside back cover

Dry-Film Lubricant Can Be Applied to Any Clean Metal

Molykote PVE-K250, an improved bonded dry-film lubricant for cutting tools, can be applied to any clean metal surface, according to the manufacturer. In addition, the new compound is a single-package coating, in contrast to Molykote PVE, the two-package-type compound which this new material is said to replace.

The PVE-K250—which reportedly lengthens the life of such tools as gear cutters, reamers, and taps by preventing metal pick-up or build-up on cutting tool flanks—is non-inflammable and requires no spray booth.

After tools have been evenly sprayed with a thin coat of the compound, and allowed to dry in air for 30 minutes, the coating is cured for one hour in an oven heated to 140 F. Parts are ready to use after cooling.

Alpha-Molykote Corp, 65 Harvard Ave, Stamford, Conn

MORE DATA? Circle 85, inside back cover

Alloy Flux Deposits Are Rh 19 C As Welded, Work-Harden to Rh 53 C

Agglomerated alloy flux for submerged arc fabricating or rebuilding 12- to 15%-manganese steel parts gives austinetic deposits that have a hardness Rh C of 19 as welded, but will work-harden to Rh 48 to 53 C on the surface.

Yield strength of weld metal deposits produced with the flux, known as M-210, is 64,400 psi and ultimate strength is 107,500 psi. with elongation of 35% in 2 in.

Typical deposition rates for single electrode submerged arc welding equipment at 350 amp dc setting is 16.2 lb of metal per hr. at a 100% operating time factor (arc time precent of welding time). Deposition rates can be increased to 47 lb per hr at 900 amp dc and 100% operating factor with twin arc equipment.

Lincoln Electric Co, Cleveland, Ohio

MORE DATA? Circle 86, inside back cover

Transparent Plastic Skin Protects Metal Surfaces During Forming

Metal Skin is a fully transparent polymer film that can be rolled onto the surface of any metal to protect it in forming operations. Because it is transparent it permits continuous inspection of the metals through every step of production and shipping. Removal consists of peeling the skin off in one piece—no solvents are needed.

The skin is resistant to most acids, alkalies, oils, and solvents and offers excellent protection against moisture. It will not support combustion and when exposed to an open flame will first melt then char. Depth of draw without loss of adhesion to the base metal is 8.5 mm on an Erickson standard metal testing machine. Burst strength (Tappin-Mullins) is 15 lbs per sq in. and tensile strength is 7000 to 12,000 psi.

Metal Skin Corp, No 3 Tenafly Rd, Englewood, NJ

MORE DATA? Circle 87, inside back cover

Teflon Pipe Thread Compound Prevents Thread Galling

Flexrock 25, Teflon Pipe Dope, a thread sealing compound for chrome, chrome plate, nickel, steel, ceramic, and plastic pipe threads is said to prevent galling of pipe threads because of its lubricating action. This action also enables users to dismantle pipe readily even after long periods of exposure to rigorous conditions.

Test made by the manufacturer on lines conveying strong acids, alkalies and solvents indicate that at temperatures of 150 to 500 F good sealing is achieved without application of maximum torque.

Flexrock Co, 2417-X58 Federal St, Philadelphia 1, Pa

MORE DATA? Circle 88, inside back cover

Steel-Sheathed Tungsten Carbide Rod Coats Smoothly As Mild Steel

New solid-core Kenface Arc Rod KT-200 is specifically designed for large pieces on which gas application is not practical.

The solid tungsten carbide core is surrounded by a steel sheath with a coating that permits depositing a hard surface as smooth as that applied by a mild steel welding rod, according to the manufacturer.

Suitable for either bead or wash application, the rod can be applied by either ac or dc reverse polarity current (160-200 amp. 16-20 v). Rh C hardness of deposits ranges from 58 to 63 for a single pass and from 60 to 65 for a double pass. 1 lb of rod will cover 25 sq in, ⅛ in. thick.

Kennametal Inc, Latrobe, Pa

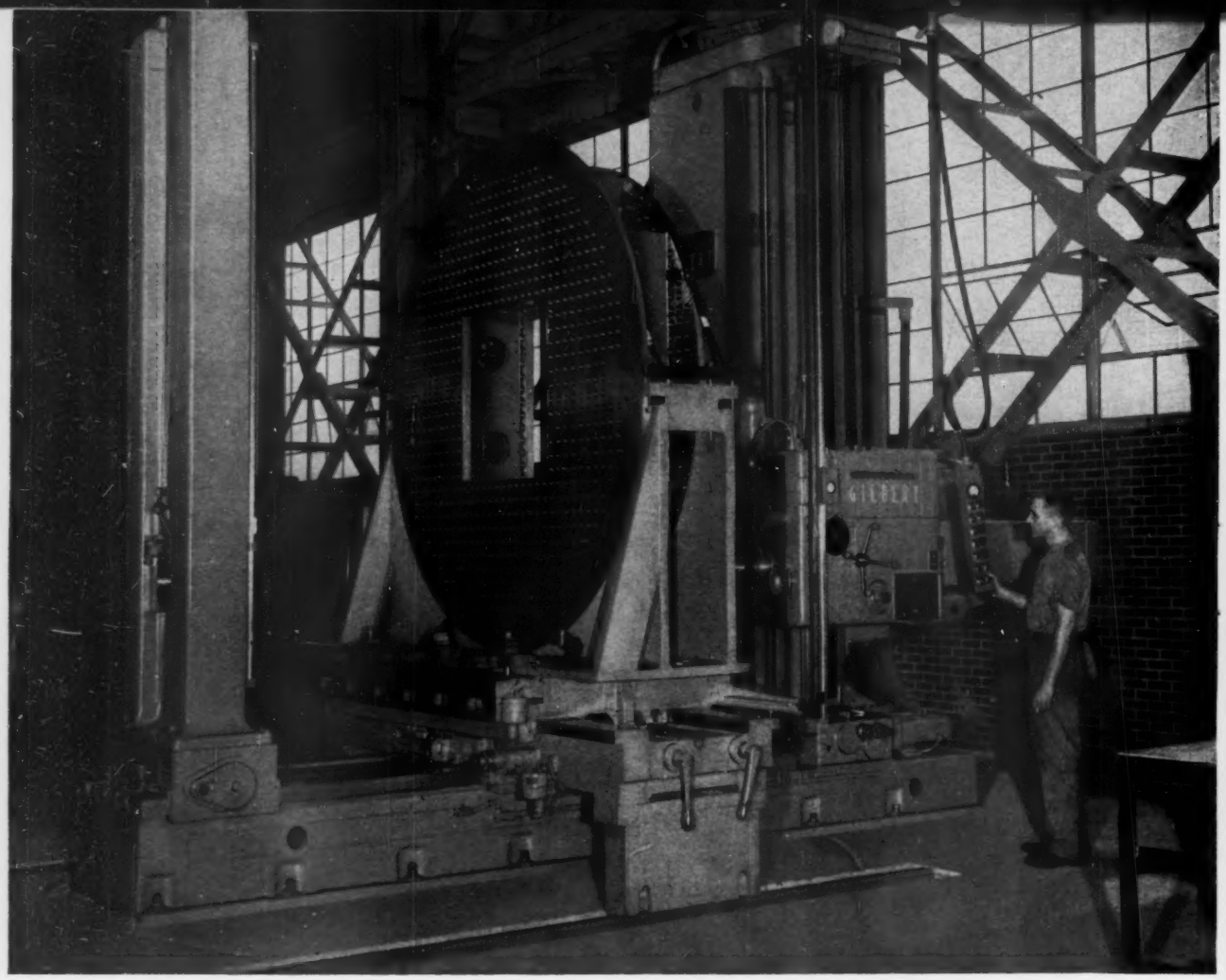
MORE DATA? Circle 89, inside back cover

Tungsten-Rhenium Alloy in Strip And Wire Form Melts at 5800 F

Tungsten - 26% Rhenium in wire sizes of 0.0005 in. dia and lengths over 2000 ft. is available as a production item. Also available are short lengths of 4-in. wide strip in 0.005 in. thickness. The alloy wire and strip are said to have high tensile strength at elevated temperatures, good ductility, and a melting point of 5800 F.

Hoskins Mfg Co, 44445 Lawton Ave, Detroit 8, Mich •

MORE DATA? Circle 83, inside back cover



Courtesy Combustion Engineering, Inc.

Combustion Engineering uses Gilberts for precision boring on atomic reactors

It takes an unusual boring mill (specifically, a Cincinnati Gilbert) to meet the specifications on this job:

(a) diameters within .001″,

(b) parallelism of center line of holes to center line of plate within .0001″ per inch,

(c) parallelism of flat surfaces within .010″,

(d) 32 R.M.S. surface finishes.

These are some of the machining requirements on this part for a fast breeder reactor built in the Chattanooga plant of Combustion Engineering, Inc., pioneer manufacturer in the nuclear field. They are typical of the quality of work assigned to this Cincinnati Gilbert table type horizontal boring mill. Automatic positioning makes work-handling fast and precise.

A number of other Gilbert boring mills are producing similar close-tolerance work for Combustion Engineering—proof that "those who buy Gilbert buy Gilbert again."

New Bulletin 1157 will show you why Gilbert boring mills do so many things so well.

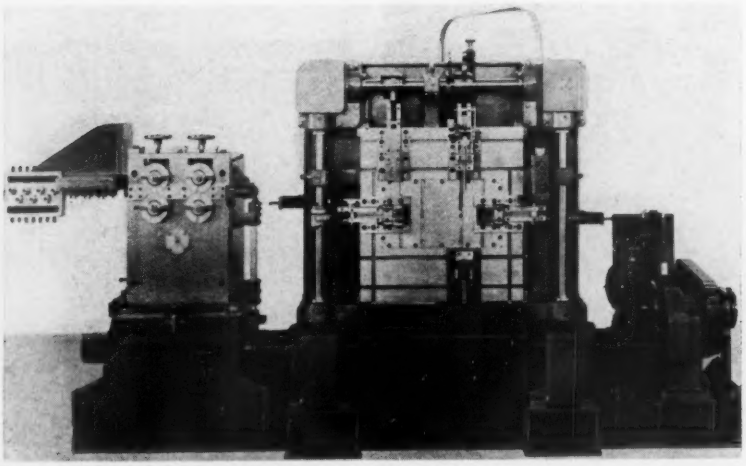
The Cincinnati Gilbert Machine Tool Co., 3340 Beekman Street, Cincinnati 23, Ohio.

Ask for free catalog 1157

GILBERT

CIRCLE 331 READER SERVICE CARD

New Shop Equipment



Torrington Modular Verti-Slide Forms 2-ft Wire, Strip Lengths Into Parts at 120/min

New Verti-Slide machine designed specifically for forming wire and strip parts in lengths up to 2 ft., will turn out up to 120 parts per minute. Modular design of the machine, designated the VLW-83, makes the feed, drive, and forming parts separate but interlocking units.

Forming unit (center) includes cam shafts, tool plate and forming slides. Cam shafts are removed through bevel gears and corner gear cases to add or remove cam hubs. Up to eight interchangeable forming-slide units can be mounted in any position in T-slots at top, bottom, and sides of the tooling plate.

Drive unit (right) with variable-speed drive and belt-driven reduction section may be coupled to either side of the forming unit.

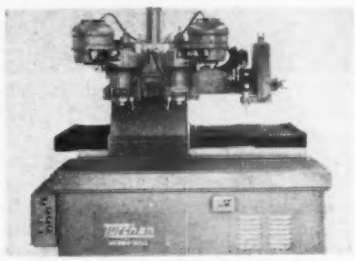
Feed unit (left) contains four spring-backed feed rolls and may be powered from the lower cam shaft at either side of the forming unit. Slide gears can be set for 90 or 180 degree feed. Additionally, the feed unit can be moved in or out to change the wire line distance to the forming area and to accommodate presses.

Maximum wire diameter is 0.250 in. for limited bends, 0.207 in. for unlimited bends, and max strip width is ¾ in. Slide strokes are 2½ in. at top and 4 in. at bottom and sides. Actuation is either through box cams for high production or plated cams for short runs.

The machine's center form is adjustable over a lateral range of 24 in. in the 13 ⅞ by 26 ⅝-in. toolplate, and multiple rear motions have max strokes of ¾, 1⅛ and 1½ in. These rear motions can be tilted up to 10 degrees up or down to compensate for spring-back on right-angle bends.

Machine Div, Torrington Mfg Co, Torrington, Conn

MORE DATA? Circle 51, inside back cover



Turchan Dual-Spindle Hydro-mill Profiles, Contours Large Parts

Extra-large parts can be machined on the 20¾-by 78¼-in. stationary work table of this new Hydro-Mill. Maximum size of a part or model is 13 by 36 by 12 in.

The unit, with a center distance between its dual spindles of 18 in. is equipped with a tracer control for combination profiling and contouring. The tracer controls hydraulic actuators on the vertical slide, saddle, and ram. Feed rates on all three dimensions are up to 40 ipm.

Power for the spindles is optional up to 5 hp, with speed of 150 to 11,750 rpm obtainable.

Other features include: auxiliary spindle controls, mist-lubrication of spindles, screw adjustment on each spindle, automatic spindle brakes, and covered ways.

Turchan Follower Machine Co, Box 157, Inkster, Mich

MORE DATA? Circle 52, inside back cover

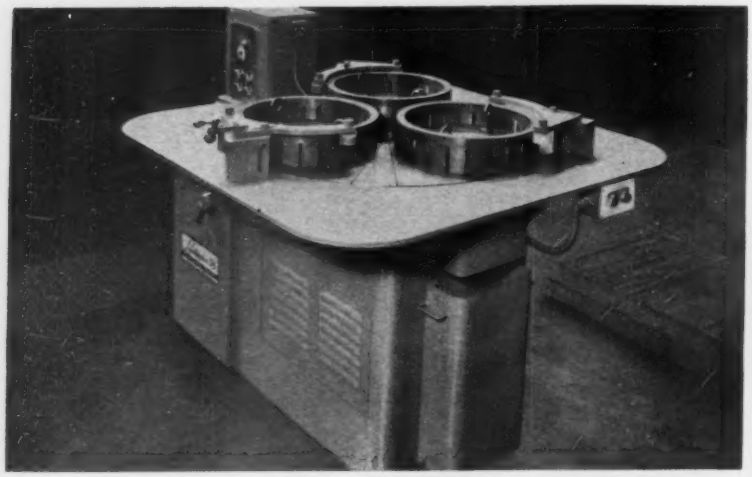
Scully-Jones Tooling System Speeds Chucker Setups

Quick-Set tooling which reduces job changeover time between 50 and 75% can justify use of single-spindle chuckers on runs as small as 25 pieces. New cross-slide and turret toolholders are part of a complete system for making chucker setups faster and easier. A job which normally might take four hours to set up on a chucker can be tooled in half the time; repeat setups can reportedly average 30 minutes or less.

All cutting tools are preset in the holders using bench gages. Dimensions for settings are programmed on layout drawings so that, while the machine is producing, cutting tools for another job may be made ready to produce on the first cut after changeover. Holders for end cutting tools are inserted into hydraulically actuated chucks. Cross-slide tools are held in magazines and clamped in place by heavy disk springs; spring pressure is released by a hydraulic piston. Company guarantees its system to hold tolerances to ±0.001 in.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill

MORE DATA? Circle 53, inside back cover



Crane 36-in. Lapping Machine Maintains Proper Abrasive Mix Throughout Operation

Completely redesigned version of the 36 in. Lapmaster, the current Model 36 includes a new abrasive distribution system that maintains the correct mixture of compound to vehicle from the initial filling to the last drop.

Pressure pumping at a constant head assures a uniform deposit at the lapping stations and provides an adjustable flow control so that maximum stock removal can be obtained. Easier loading of parts from any position is possible because of a remote start and stop station, and an adjustable work table that can be raised or lowered to be in the same plane as the lap plate.

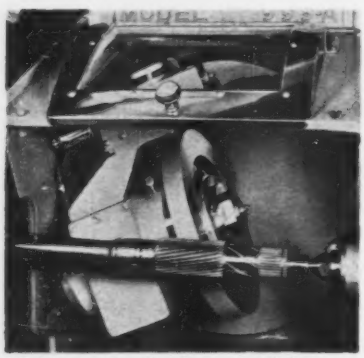
A hand screw is provided for adjusting the conditioning ring to compensate for normal wear patterns in the lapping plate.

The Model 36 is equipped with either 3 or 4 conditioning rings and can be furnished with pneumatic lifts for raising and lowering these rings and or pressure plates.

Tolerance on production lapping is one light band or less and finish is said to be uniform at 2 to 3 microinches.

Crane Packing Co, Dept AM-3, 6400 Oakton St, Morton Grove, Ill

MORE DATA? Circle 54 inside back cover



Michigan Tool's Gear Finisher Gives 4-Motion Honing Action

Four-motion honing action, available on the company's new 999-A machines, is said to give better surface finishing of gears and other parts after hardening. In addition, new and improved abrasive tools ranging from extremely fine to coarse grits for extremely fine finishes or rapid finishing have been announced.

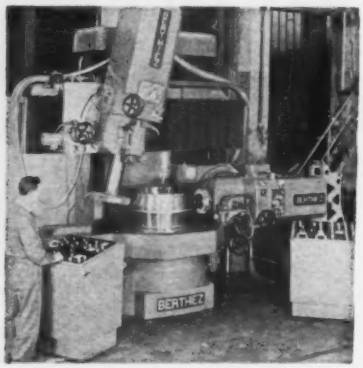
For finishing gears, the abrasive hone used is a gear-like tool made of a new special high-strength plastic impregnated with abrasive. It is rotated in tight mesh with the hardened work gear at crossed axis. The honing action on the gear teeth is achieved by combining four motions:

- An in-mesh rotation under controlled load;
- Crossed axis relationship between hone and work;
- High-speed axial oscillation of the tool in a ratio of 3 oscillations per 1 revolution of the tool;
- Reciprocating motion which traverses the work a preset amount across the hone for the gear's full face width.

Hone rotation is variable from 150 to 600 rpm, table reciprocation can be independently varied, tool head angle is variable up to 25 degrees. The 999-A will handle gears up to 12 in. in diameter, up to 5-in. face width, and has a maximum distance between centers of 30 in.

Michigan Tool Co, 7171 E McNichols Rd, Detroit, Mich

MORE DATA? Circle 55 inside back cover



Berthiez Vertical Grinder, Boring Mills Displayed at European Show

One of several new machines shown at the European Machine Tool Exhibition by the company, this vertical chucking grinder was originally designed for the roller bearing industry but is well fitted for grinding precision bores, cylinder liners, or tube mill rollers, the company says.

Features of the machine include a hydraulically - balanced toolholder, both on the arm and upright, hydraulic control of the spindle carriage movements in both directions, with automatic change from normal reciprocating feed motion to slow down and stop, dwell adjustable from 1 to 20 seconds, and electrohydraulic remote control of inching movement.

Designated the VG-100, it has table diameter of 40 in., and a vertical displacement of the ram of the tool heads on the arm and on the upright from 1 to 98 in.

Spindles, driven by 15 hp and 8 hp motors, have a minimum speed of 1200 rpm and a maximum speed of 3,000 rpm. This allows the use of grinding wheels with diameters from 8 to 18 in. Table speed range is from 2 to 50 rpm.

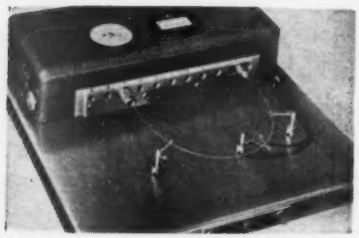
Other new machines shown by the company are:

- Single upright vertical boring and turning mill, type J-100. This fixed height machine has a table diameter of 40 in. and is fitted with an electromagnetic copying attachment.
- Single upright vertical boring and turning mill, type BM-225, with a displaceable table of 89-in. dia and

a maximum turnable diameter of 178 in. Machine is fitted with two toolheads on the arm and one toolhead on the upright.

Berthiez, 5 rue Montavilet, Paris 8, France or International Merit Products Corp, 25 Beachwood Ave, Mt Vernon, NY

MORE DATA? Circle 56, inside back cover



Hunter Rotating Beam Fatigue Tester Has Increased Reliability

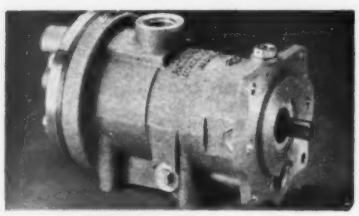
Although this new model of the 802 rotating beam fatigue tester closely resembles its predecessor, it has new functional features which are said to increase reliability, ease maintenance, and simplify operation. It offers a life expectation in excess of 1 million tests.

The tester, which accommodates wire specimens from 0.004 to 0.030-in. diameter, has only one tube, a thyratron. Also, because the entire circuit is incorporated into a single plug-in unit, it is easy to remove and replace. Since no warm-up period is required, the instrument has a single switch.

The time meter records test duration to the nearest 1/10 minute from 0 to 9999.9 minutes. This information, plus the point of specimen failure, provides data for calculation of wire endurance. Price of the tester is $875, fob factory.

Hunter Spring Co, Div of American Machine & Metals, Inc, 1 Spring Ave, Lansdale, Pa

MORE DATA? Circle 57, inside back cover



Variable Displacement Hydraulic Pump Introduced by Weatherhead

The WO-7, a versatile variable displacement pump can operate continuously at no flow while maintaining full system pressure (3000 psi) without additional power and with a minimum of heat-dissipated energy. Flow can quickly be changed to 9 gpm at low pressures. Heart of the pump is a non-rotating balanced cylinder block that is moved back and forth to change the pump's displacement. Reaction pistons balance the hydraulic forces exerted on the cylinder block during pumping and these, coupled with a special wobble-type reaction plate design are said to virtually eliminate pumping forces from the displacement changing mechanism.

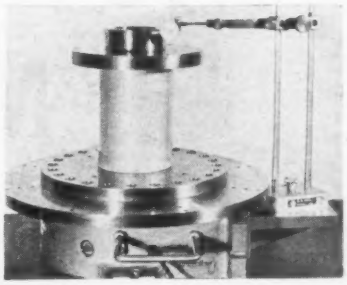
The seven-cylinder pump has only two rotating components, the drive shaft and cam, and because side loads on the pistons are minimized by self-aligning connecting rods in spherical seats, the speed range of the pump is high (45 to 4500 rpm).

Displacement can be controlled manually by means of handwheels or levers or by response to remote hydraulic signals. Nominal output is 9 gpm at 3600 rpm continuous.

Rugged design plus a variety of optional bearings enable the pump to operate on fluids of low lubricity (brake fluid).

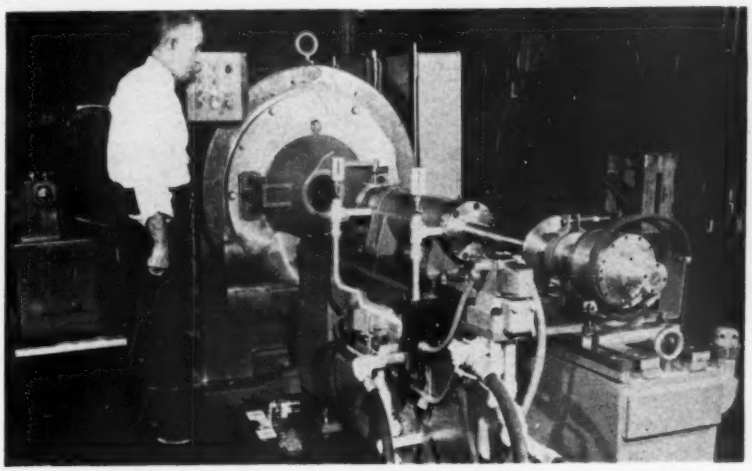
The Weatherhead Co, Cleveland, Ohio

MORE DATA? Circle 58, inside back cover



NEW 24-IN. ROTOGRIND, model 724-B, allows checking of concentricity and flatness as well as grinding of parts to less than 50 millionths. Powered operation permits checking with both hands free.—*M & M Tool & Mfg Co, 1124 E Third St, Dayton, Ohio*

MORE DATA? Circle 59, inside back cover



Fenn Hydroformer Forms Fittings For Cables, Doubles As Rotary Tube Swager

Size capacity of the new 3H Hydroformer has been doubled so that the modified rotary swaging machine can now swage fittings up to 1⅝ in dia.

Modification permits insertion and withdrawal of workpieces so that they can be swaged between shoulders.

The machine can also be used as a conventional swaging machine for producing convoluted semi-flexible tube or convoluted tubing. When used in this manner it will form non-ferrous light-wall tubing up to 4½ in. dia and low-tensile-strength solid stock up to 2¼ in dia.

A one-piece meehanite frame with the spindle housing as an integral part supports the heavy loads imposed on the machine and insures proper alignment of the spindle and other elements.

Elements consist of a hardened steel head ring, a set of 12 caged rollers, a pair of opposing dies, and operating wedges.

The illustrated machine has a special automatic feeder for the cable to which fittings are attached.

Fenn Mfg Co, Newington, Conn

MORE DATA? Circle 60, inside back cover

To Help You Cut Costs– Movie on Machining

"Machining Armco Stainless Steels—Part II" presents down-to-earth information and tips on how to get best results at least cost.

Stainless Steel

For Durability, Strength and Economy

This, the second part of a motion picture presentation on how to machine stainless, brings more of Armco's 30 years of practical experience right into your shop. In an easy to understand manner, it shows how maximum results can be obtained in specific machining operations, particularly on automatics.

Everyone in your shop—set-up men, operators, tool designers—will find the film helpful. Forming, drilling, reaming, tapping, threading, cutting fluids, and tool grinds are discussed. You'll see how to reduce excessive tool wear and how to select and grind cutting tools to obtain best chip formation. There are helpful hints on the design of jigs and fixtures, too. The film is devoted to helping

New steels are born at Armco

Another Armco Stainless Steels

you machine stainless steel parts in the shortest time, with the best surface, and at the lowest cost.

Plan to arrange a showing of "Machining Armco Stainless Steels —Part II" in your plant. And insure highest quality at low cost by using Armco "Controlled Uniformity" Stainless Steel. We will be glad to lend you the film free of charge. To request it, just write our film distribution agency: The Jam Handy Organization, 2821 E. Grand Blvd., Detroit 11, Mich. Or, contact the nearest Steel Service Center handling Armco Stainless Steels. **Armco Division, Armco Steel Corporation, 3021 Curtis Street, Middletown, Ohio.**

ARMCO Armco Division

GET ARMCO STAINLESS STEELS FROM THESE STEEL SERVICE CENTERS

(A) Sheets, Strip and Plates (B) Bars and Wire

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AMERICAN STEEL & ALUMINUM CORP. OF MASS. Cambridge, Mass.	(AB)
BROWN-WALES COMPANY **Cambridge, Mass.**—Auburn, Maine—Worcester, Mass.	(AB)
CENTRAL STEEL & WIRE COMPANY **Chicago, Ill.**—Cincinnati—Detroit—Milwaukee	(AB)
CHICAGO STEEL SERVICE COMPANY Chicago, Ill.	(AB)
CLEVELAND TOOL & SUPPLY COMPANY Cleveland, Ohio	(B)
THE CONDON AND CARPENTER COMPANY **Providence, R.I.**—Fall River—Natick, Mass.	(AB)
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DUCOMMUN METALS & SUPPLY COMPANY **Los Angeles, Calif.**—Berkeley—Phoenix—San Diego—Seattle	(AB)
EDGCOMB STEEL & ALUMINUM CORP. Hillside, N. J.	(AB)
EDGCOMB STEEL COMPANY **Philadelphia, Pa.**—Charlotte, N. C.—Greensboro, N. C.—York, Pa.	(AB)
ESCO CORPORATION **Portland, Oregon**—Denver—Emeryville, Calif.—Eugene, Oregon—Honolulu—Los Angeles—Seattle—Spokane—Vancouver, B. C.	(AB)
PETER A. FRASSE & COMPANY, INC. **New York, N. Y.**—Buffalo—Hartford—Lyndhurst, N. J.—Philadelphia—Syracuse	(AB)
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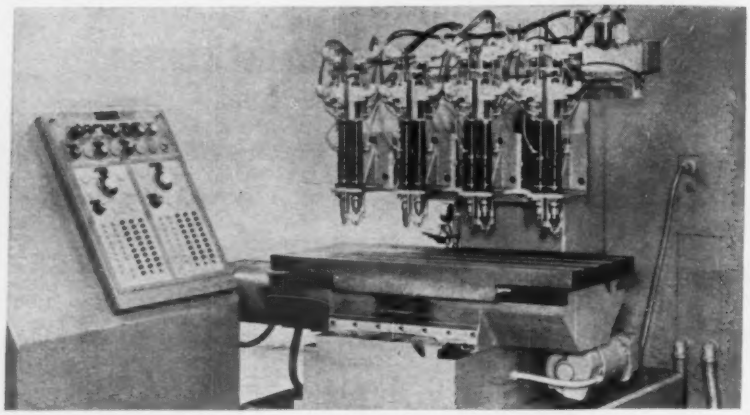
INDUSTRIAL STAINLESS STEELS, INC. **Cambridge, Mass.**—Buffalo, N. Y.	(B)
EARLE M. JORGENSEN COMPANY **Los Angeles, Calif.**—Dallas—Denver—Honolulu—Houston—Oakland—Phoenix—Seattle—Tulsa—Wichita	(AB)
MAPES & SPROWL STEEL COMPANY Union, N. J.	(AB)
METAL GOODS CORPORATION **St. Louis, Mo.**—Dallas—Denver—Houston—Memphis—New Orleans—N. Kansas City, Mo.—Tulsa—Wichita	(AB)
MONCRIEF-LENOIR MFG. COMPANY **Houston, Texas**—Dallas—Harlingen—Lubbock—San Antonio—Temple	(AB)
MORRISON STEEL COMPANY New Brunswick, N. J.	(AB)
THE ORLEANS STEEL PRODUCTS COMPANY, INC. New Orleans, La.	(A)
WILLIAM M. ORR COMPANY, INC. Pittsburgh, Pa.	(AB)
PAPER-CALMENSON & COMPANY St. Paul, Minn.	(A)
SEABOARD STEEL & IRON CORP. Baltimore, Md.	(B)
SENECA STEEL SERVICE, INC. Buffalo, N. Y.—Jamestown, N. Y.	(AB)
SOUTHER STEEL & ALUMINUM COMPANY St. Louis, Mo.	(A)
J. M. TULL METAL & SUPPLY CO., INC. **Atlanta, Ga.**—Birmingham—Greenville, S. C.—Jacksonville—Miami—Tampa	(AB)
VIKING STEEL COMPANY Cleveland, Ohio	(AB)
VORYS BROTHERS, INC. Columbus, Ohio	(AB)
YORK CORRUGATING COMPANY **York, Pa.**—Washington, D. C.	(A)

CIRCLE 333 READER SERVICE CARD



Numerically Controlled Multi-Cluster Machine Drills Printed Circuit Boards

Designed for drilling printed circuit boards of a wide variety of materials and thicknesses, this numerically controlled, tape-programmed driller, Model NPB, consists of a tape-controlled point-positioning table and four drilling clusters, each with four independent air feed drill units.

The four clusters act as four coordinated drilling units, eliminating the costs of individual control sysems, bases, and power plants for each. Under average conditions, the machine operates at 50 cpm and drills four boards at once, resulting in 200 holes per minute. If four boards are stacked, 16 can be drilled simultaneously. Each of the four heads in a cluster can carry a different drill size up to ⅛ in. and can operate at different speeds, if desired, up to 22,000 rpm.

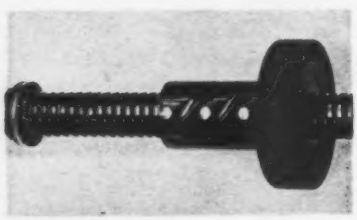
The point positioning table has a travel of 14x20 in. at 200 ipm and a flat working surface of 18x44 in. It is built with a 2-in. zero offset in each axis, allowing the table movement needed for changing to different drill sizes.

Maximum drilling pattern varies according to the number and size of the drills being used. With two sizes of drills in each of two clusters, maximum pattern is 14x18 in. or 12x20 in.; with four sizes in each of four clusters, maximum pattern is 10x12 in.

The machine was designed for use with a GE Mark II numerical positioning control having buffer storage and fast reading. It is also available, however, with a standard Mark II without the buffer storage.

Edlund Machinery Co, Dept P-CB, Cortland, NY

MORE DATA? Circle 61, inside back cover



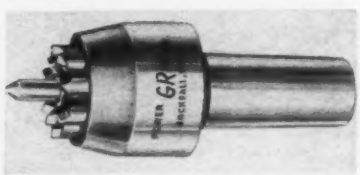
Steel and Nylon Washers Limit Travel of Ball-Bearing Screws

In these newly designed ball-bearing screw assemblies, a set of three washers—two steel and one nylon—replaces each stop pin previously used to achieve freewheeling action. In addition to being less expensive, the stronger washers are also said to eliminate any danger of breakage.

Mechanical efficiencies range from 80 to 95%, and there is no tendency for the units to creep under load. The actuators can also be used as holding devices or forward-stop-reverse systems.

Saginaw Steering Gear Div, General Motors Corp, Saginaw, Mich

MORE DATA? Circle 62, inside back cover



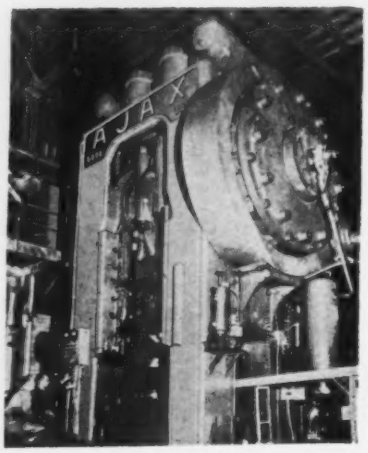
Special Driving Centers Cut Chucking Time

Powergrip line for holding many different types of workpieces is engineered to hold tubular work for OD turnings, grinding, or cutting spines. Two handlings are usually required for these operations; use of these centers permits workpiece to be completely finished in one chucking

One special driving center has a long piloted center point to position the work, which can be loaded manually or by automatic loader. Work will stay in position on this center point until the tailstock moves in and driving points engage the piece. This model is used when the OD must be completely machined from end to end, or where any outside holding would interfere with tools. A heavy cut can be taken from end to end because the drive pins grip the work near its maximum OD.

Powergrip Inc, Rockfall, Conn.

MORE DATA? Circle 63, inside back cover



Huge Forging Press Forms 130-lb Steel Ring Gears in Three Strokes

6000-ton mechanical forging press produces 18½-in. dia 130-lb ring gears from SAE 8620 and 4178 steel in only three strokes, at a rate of over 100 an hr. Formerly the parts required from 25 to 45 strokes with a large drop hammer. The press' eccentric-driven ram is powered by a 400-hp motor which carries it through its 18-in. stroke at 35 strokes per minute.

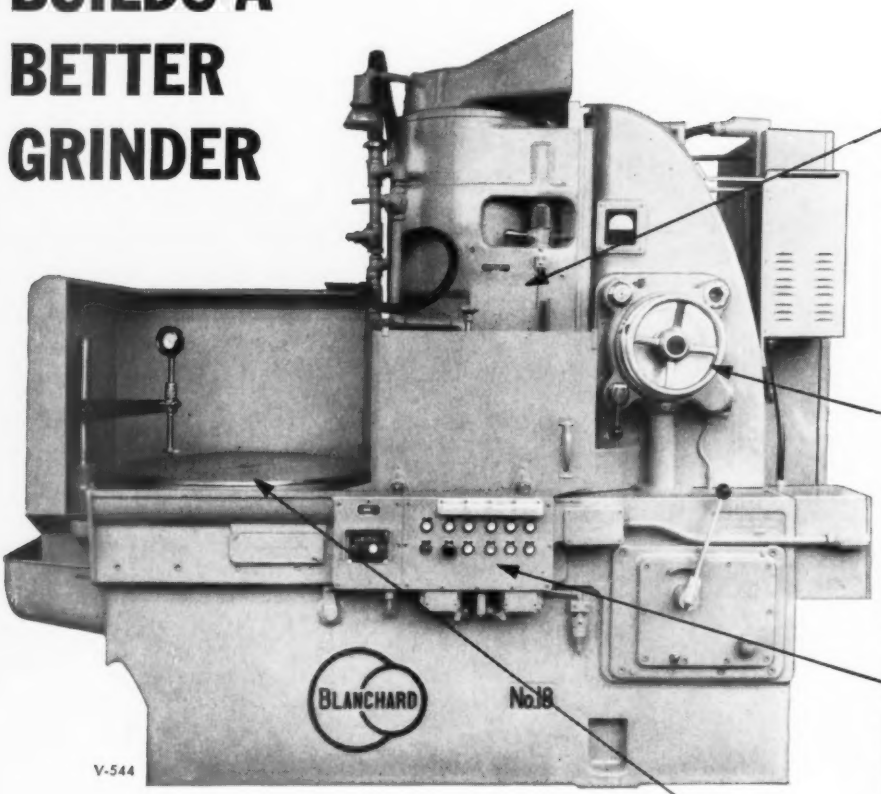
Working area of the press is 70 in. right to left, 74 in. front to back and is open for through feed by mechanical manipulators.

The 24-ft high press weighs 930,000 lb (the drive shaft alone weighs 50,000 lb) but is said to have a smooth, shock-free stroke that will not damage linings in nearby furnaces or disturb precision machinery.

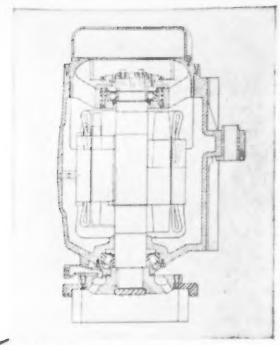
Ajax Mfg Co, Cleveland, Ohio

MORE DATA? Circle 64, inside back cover

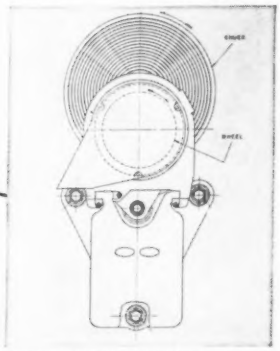
HOW BLANCHARD BUILDS A BETTER GRINDER



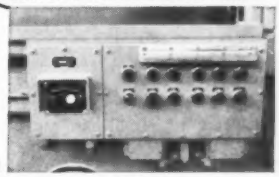
V-544



SPINDLE . . . incorporates a superior, pre-loaded anti-friction bearing system that removes all backlash and radial play. Integral "balanced" mounting of rotor on spindle eliminates vibration.



WHEEL HEAD COLUMN . . . is of heavy box-section design for extra rigidity . . . supported at 3 widely-spaced points. Column may be easily adjusted for alignment. Special column tilting devices available to produce concave or convex surfaces.



V-541

GRINDER CONTROL . . . is compact and conveniently located for fatigue-free handling. All control panels are BLANCHARD manufactured for troublefree operation.

W-949

MAGNETIC CHUCK . . . provides maximum useful magnetic surface . . . has such closely spaced poles, that work as small as a quarter will always touch two or more.

There's no mystery about the *better* performance you get with a BLANCHARD Surface Grinder. It's simply a matter of *better* design of each individual machine part. For example, look at just 4 features of the No. 18, shown at the right.

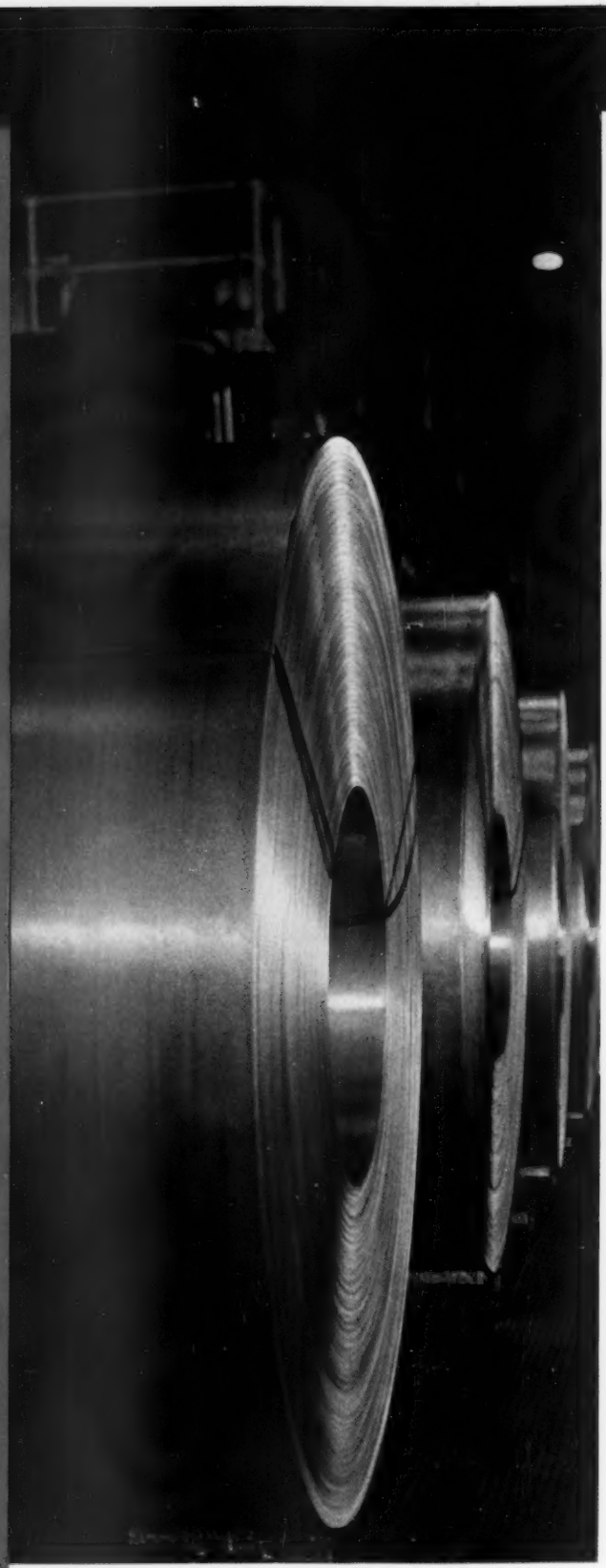
Get complete details on all 24 models of BLANCHARD grinders. They're today's leading high precision, high production grinders on materials ranging from carbon to quartz . . . from bronze to steel. You can handle parts ranging from tiny jewels to giant plates up to 108″ across corners.

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**

64 State Street, Cambridge 39, Massachusetts

CIRCLE 334 READER SERVICE CARD ▲

CIRCLE 335 READER SERVICE CARD ►



NEW 79"

You get larger coils, higher quality from Youngstown's big, new 79" hot strip mill

Higher quality hot rolled steel sheet in larger coils. That's what you get from our expanded and modernized 79" hot strip mill in Campbell, Ohio. To bring you improved hot rolled sheet and strip, more than $60,000,000 was invested. Probing television monitors and delicate, sensitive electronic devices plus massive roll stands, and bigger coilers combine to bring you even better quality control.

These improvements in our hot strip mill are only part of Youngstown's sheet and strip story. New coil annealing facilities, a new shear line and a new Youngstown open coil annealing process for one coat enameling sheets give you a growing source of hot and cold rolled steel products.

Get steel stamped with the mark of Youngstown. Get longer, stronger, flatter steel. Steel sheet and strip of more uniform quality. With better physical properties. Hot and cold rolled steel that is easier to work with and more economical to use because you can get larger coil sizes to 38,000 pounds. In 24" to 72" widths. Order to your specifications. Get fast, reliable delivery from your Steel Service Center or through the 28 Youngstown Offices.

Youngstown – growing force in steel

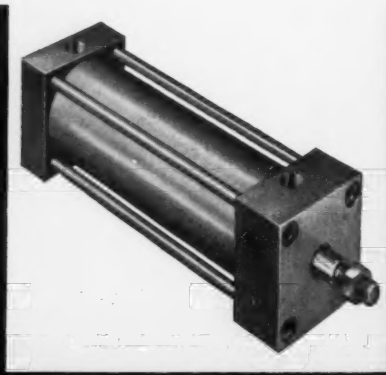
For full details on Youngstown steel sheet and strip, write: Dept. 11-A,
The Youngstown Sheet and Tube Company, Youngstown, Ohio

NEW FROM HANNIFIN

A GENERAL PURPOSE AIR CYLINDER

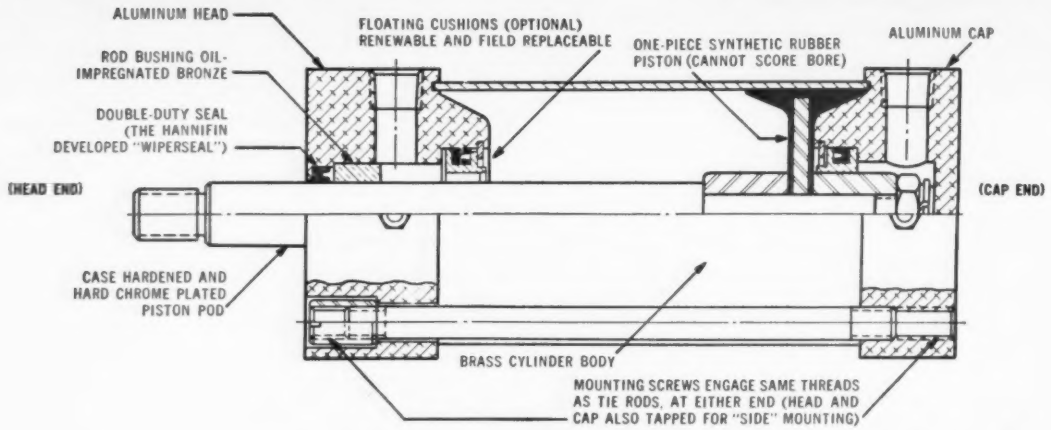
that gives you quality, low cost and mounting versatility

Hannifin announces a new design concept that gives you quality and economy in one package, the new Series "C" air power cylinder with . . .



- One compact basic design that provides side, cap end, or head end mounting without modification.
- Flange, foot or pivot mountings easily made with standard attachments.
- Rust proof construction — brass cylinder body, head and cap of aluminum.
- Cushions that do not change cylinder length — furnished as option or added in field with simple kit.
- An ingenious one piece piston that cannot score the bore — of synthetic rubber, molded around a rugged steel disc.
- Piston rod both case hardened and hard chrome plated, polished to a fine finish for low friction and long seal life. Corrosion resistant.
- Rod bearing an oil impregnated bronze bushing. Minimizes friction.
- Gland seal the Hannifin developed "Wiperseal" — both a rod wiper and an efficient dynamic seal. It keeps air in, dirt out.
- 5 bore sizes — 1¼", 1¾", 2½", 3¼" and 4½". Stock strokes from 1" to 20" in 1" increments.

This new Hannifin cylinder design is the latest of the complete Hannifin line of air power cylinders. To help you choose the best Hannifin cylinder for your application, talk to your nearby Parker-Hannifin man. He knows cylinders!


ALUMINUM HEAD
FLOATING CUSHIONS (OPTIONAL) RENEWABLE AND FIELD REPLACEABLE
ONE-PIECE SYNTHETIC RUBBER PISTON (CANNOT SCORE BORE)
ALUMINUM CAP
ROD BUSHING OIL-IMPREGNATED BRONZE
DOUBLE-DUTY SEAL (THE HANNIFIN DEVELOPED "WIPERSEAL")
(HEAD END)
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CASE HARDENED AND HARD CHROME PLATED PISTON POD
BRASS CYLINDER BODY
MOUNTING SCREWS ENGAGE SAME THREADS AS TIE RODS, AT EITHER END (HEAD AND CAP ALSO TAPPED FOR "SIDE" MOUNTING)

PARKER-HANNIFIN

PARKER HANNIFIN CORPORATION

HANNIFIN COMPANY DIVISION

517 South Wolf Road • Des Plaines, Illinois

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

◀ CIRCLE 336 READER SERVICE CARD

▲ CIRCLE 337 READER SERVICE CARD

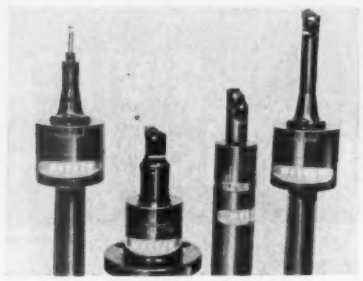
Heavy-Duty Cutoff Machine Furnished in 20 or 24-in. Sizes

M-160, for handling a wide range of ferrous and non-ferrous cutting operations, is powered by a 15-hp continuous duty, geared-in-head, TEFC ball bearing induction-type motor, 220/60/3 or 440/60/3, with load ammeter, overheating indicators, and No. 2 magnetic starter. Available in either 20 or 24-in. sizes, with stationary wheel guard, the unit may be equipped for wet or dry cutting as well as manual, semi-automatic, or fully automatic operation.

Self-centering vise with adjustable jaws clamps work close to cutting edge, regardless of angle. The vise, mounted on a heavy, cast, smooth-surfaced table, is machined for jigs and fixtures and is adjustable for angular cutting to 46°.

Stone Machinery Co, Manlius, NY

MORE DATA? Circle 65, inside back cover



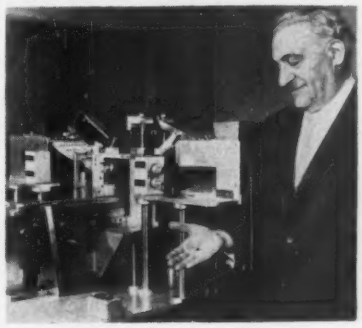
Wesson Precision Boring Bars Are Adjustable to Tenths

New boring tools have graduated scales calibrated in increments of 0.0001 in. within a range of to ¼ in. Adjustment ring that incorporates the calibrated scale is available in both standard and special boring tools. Four styles illustrated are; (from left to right)

- Boring bar with independent coarse diameter adjustment (in increments of 0.001 in.) and precision adjustment (for setting to 0.0001 in.). Total on the course adjustment is 0.250 on diameter, fine adjustment range is 0.004 in.
- Precision boring bar with total adjustment range of 0.004 in 0.0001-in. increments.
- Bar for precision boring of any size hole in any machine whether or not the bar is on centerline. Adjustable in increments of 0.0001 in. over a range of 0.008 in. it has interchangeable heads for hole sizes ranging from ½ in. up.
- Bar with coarse and fine adjustment (same as first bar) but using throwaway inserts. Size variation with interchangeable heads is ½ to 3 in.

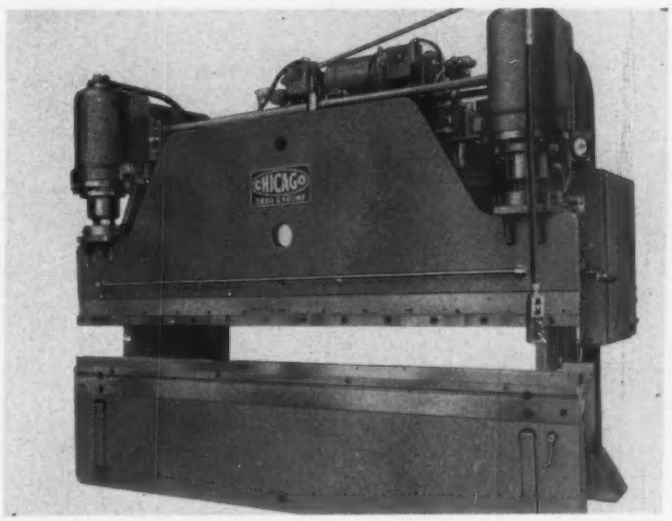
Wesson Corp, 1220 Woodward Heights Blvd, Ferndale 20, Mich

MORE DATA? Circle 66, inside back cover



TRANSISTOR HEADERS can be assembled at rate of 6000 per hr by this automatic machine which can be adapted to welding, punching, and threading. Machine can assemble as many as 40 different kinds of parts at the same time—*Rhebo Corp, 1108 W. Evelyn Ave, Sunnyvale, Calif*

MORE DATA? Circle 67, inside back cover



Chicago Press Brakes Offered in 42 Sizes From 100 to 1000 tons, 3 Ram Speed Styles

Press brakes offered in 42 standard sizes from 100 to 1000-ton capacity (200-ton size shown) have infinitely variable ram speeds within the specification limits.

Controlled by a three-position foot switch the presses also feature zero positioning, electronic sensing for ram leveling control both in center and off-center loading, and Oilgear variable-delivery pumps.

Bending lengths available in the new line range from 8 ft. 6 in. to 22 ft.; depth of throat is 8 in. on the smallest press and 16 in. on the largest.

Within the 42 sizes, 3 ram-speed types are offered: the single-speed type gives pressing speeds 0 to 45 ipm in the 100-ton size and 0 to 20 ipm in the 1000-ton size; the dual-speed type has advance speeds between 85 and 100 ipm added; and the high-speed type gives advance speeds between 150 and 160 ipm.

Complete tables of dimensions, capacities and speeds of all sizes and types up to 1000 tons are available from the manufacturer. Brakes up to 2000 tons will be built to customer specifications.

Dreis & Krump Mfg Co, 7400 S Loomis Blvd, Chicago 36, Ill

MORE DATA? Circle 68, inside back cover

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A GENERAL PURPOSE AIR CYLINDER

that gives you quality, low cost and mounting versatility

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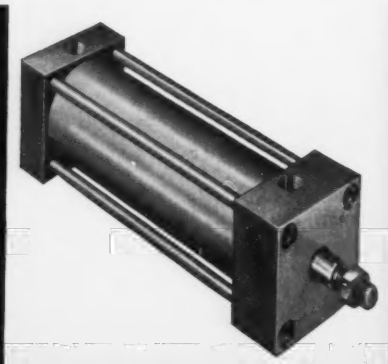

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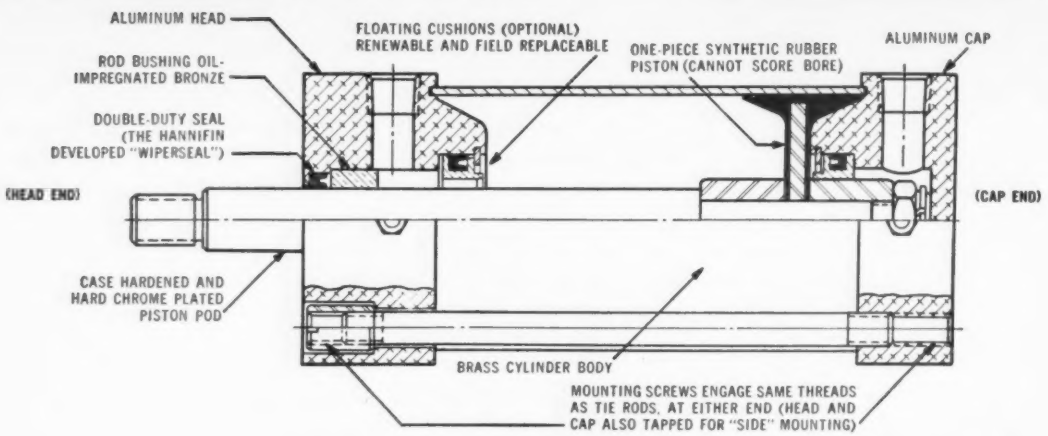
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◀ CIRCLE 336 READER SERVICE CARD

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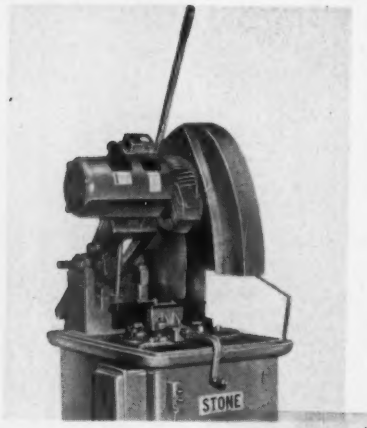

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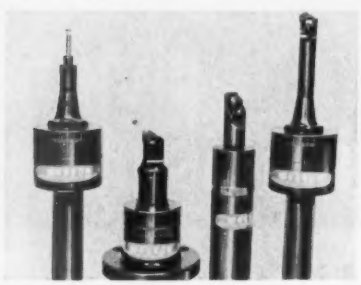
Stone Machinery Co, Manlius, NY

MORE DATA? Circle 65, inside back cover



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Wesson Corp, 1220 Woodward Heights Blvd, Ferndale 20, Mich

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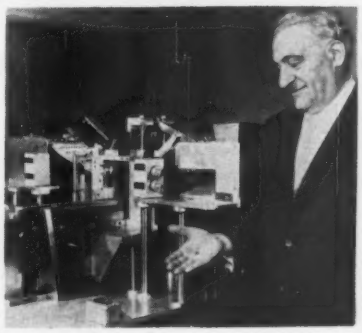

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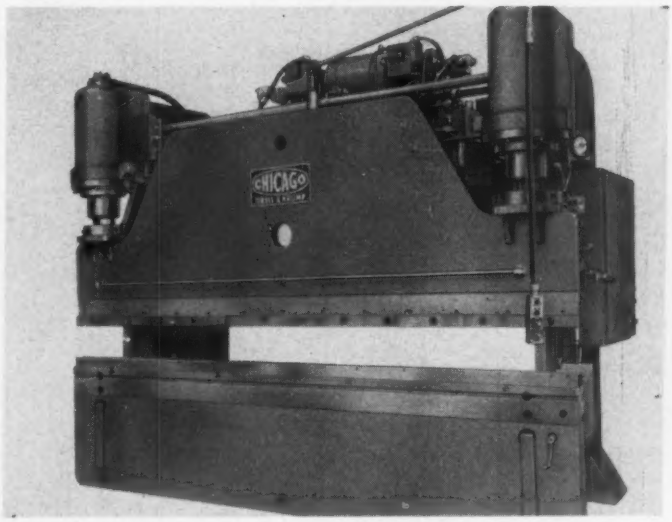

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Dreis & Krump Mfg Co, 7400 S Loomis Blvd, Chicago 36, Ill

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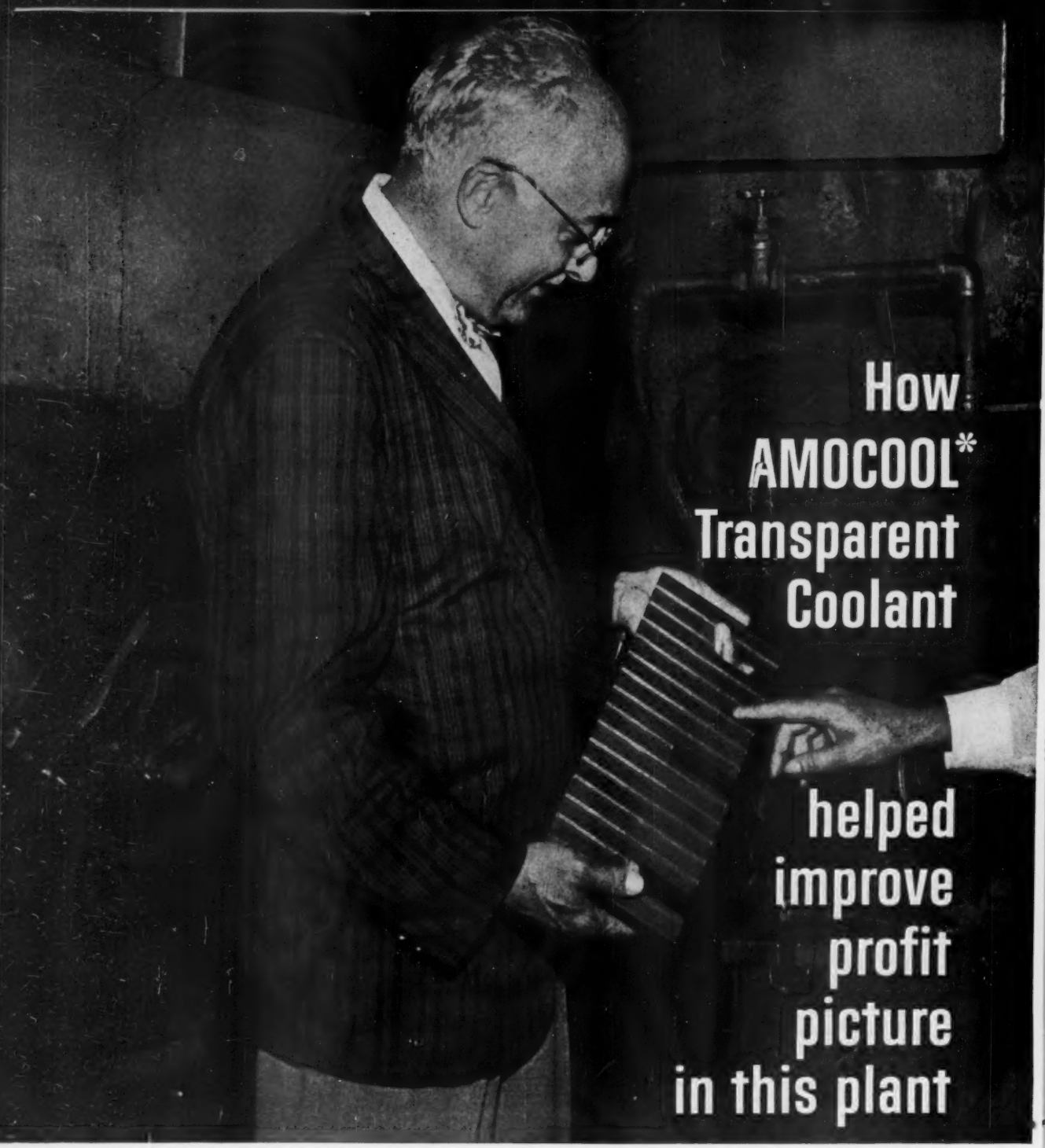


How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

BY PAUL E. "PAPPY" STRATTON

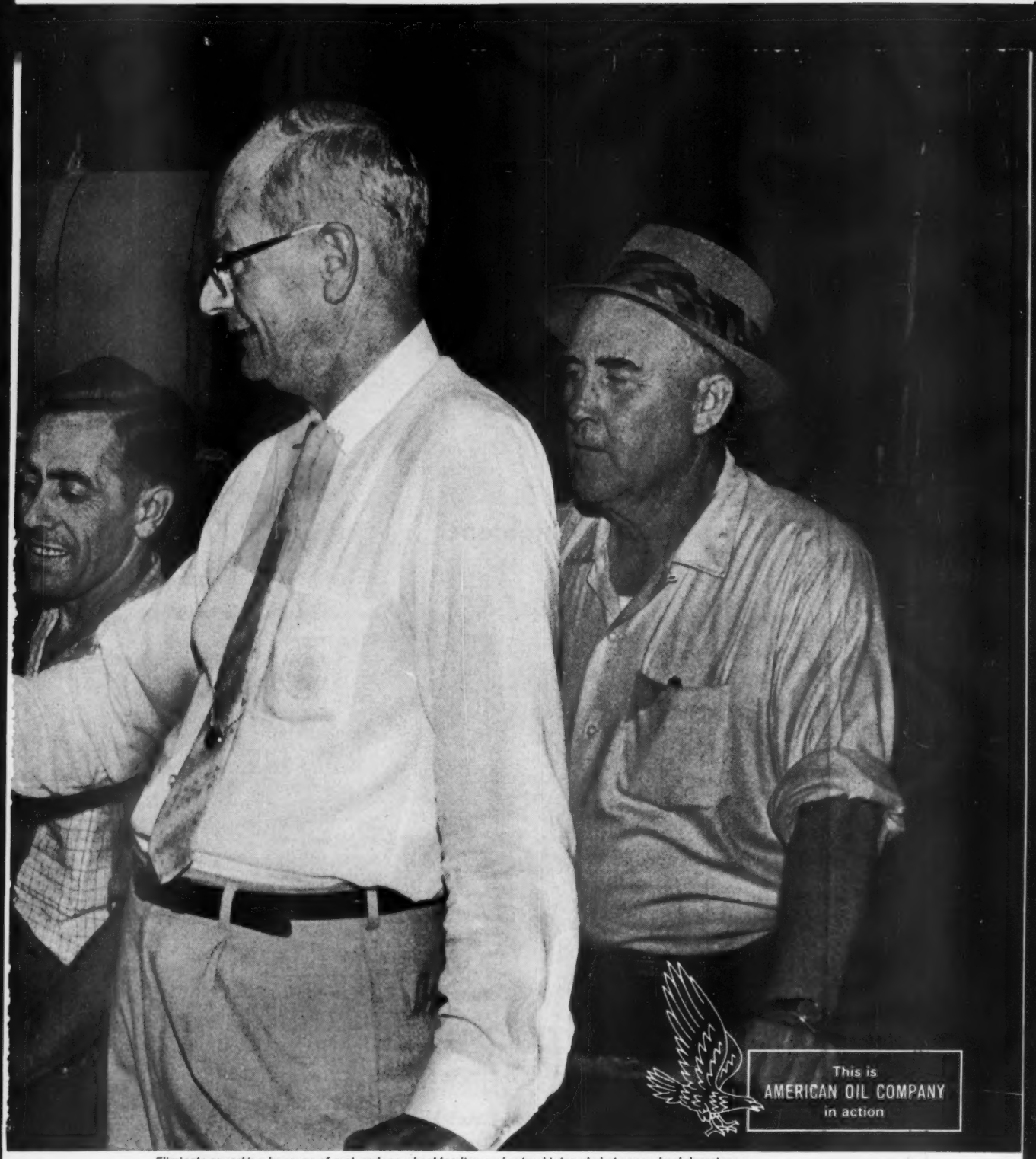
About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been working for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

* * *

By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.

CIRCLE 338 READER SERVICE CARD



Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

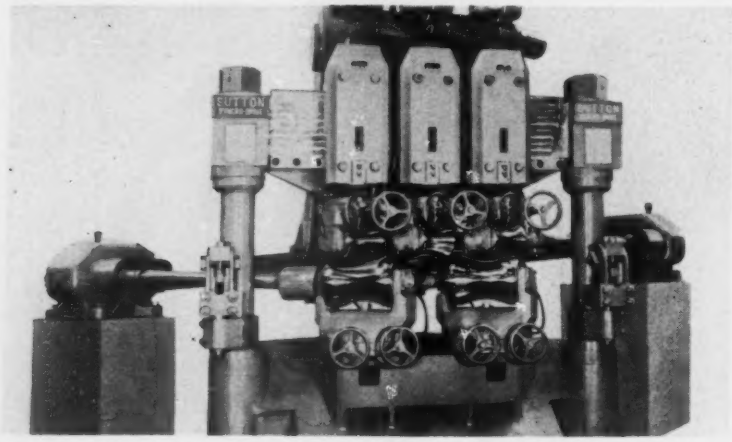
Quick facts about
AMOCOOL Transparent Coolant

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless

AMERICAN

AMERICAN OIL COMPANY
910 South Michigan Avenue
Chicago 80, Illinois

CIRCLE 339 READER SERVICE CARD



Sutton Synchro-Drive Rotary Straightener Handles 4-in. Pipe at 175 to 700 fpm

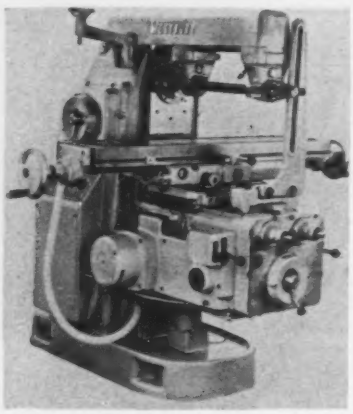
Built for precision straightening of steel tubes at high speeds, the 18 SD 5-roll rotary straightener will handle ½ to 4 in. standard, line and extra-strong steel pipe.

In the 5-roll design 2 large straightening rolls are opposed by 3 small pressure rolls and all 5 rolls are driven by a single 75- to 100-hp, 400- to 1600-rpm adjustable speed DC motor. Throughput speeds are 175 to 700 ft per min.

The machine features patented Synchro-Drive which coordinates surface speeds of each bank of rolls automatically and compensates for roll wear and differences in angular roll setting. This means less redressing and maximum roll life. With Synchro-Drive, it is claimed, users can straighten materials that were previously difficult or impossible to straighten such as thin-walled tubes and bars of stainless, brass, zirconium and titanium.

Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Pa

MORE DATA? Circle 69, inside back cover



Westbury Milling Machines Have Independent Feed, Speed Motors

Redesigned Westbury milling machines feature independent motors for speeds and feeds, dial-type speed and feed selection, electromagnetic clutch with brake on the spindle controlled by push buttons from the front of the machine, and chrome-nickel-hardened-and-ground shafts and gears. The millers are made in two sizes. The smaller size has a 55 by 11-in. table and a longitudinal travel of 37 in. It has 5½ total hp. Table size of the larger model is 63 by 13¾ in., longitudinal travel is 45 in., and total hp is 7½.

Dist by Hermes Machine Tool Co, 48-15 Northern Blvd, LIC 1, NY

MORE DATA? Circle 70, inside back cover

Rivett Lathe Features Variable Power Feeds, Power Tracer Unit

Model 1020M manufacturing lathe will take a ¼-in. cut in cold rolled steel and will turn within 0.0004 in. in 12 in. according to the manufacturer. Available in either 20- or 30-in. centers the lathe has a 12½-in. swing and its spindle takes collets up to 1⅛ in. Power longitudinal feeds are from 0 to 16 ipm and power cross feeds from 0 to 8 ipm. Both feeds are infinitely variable. A swivel-mounted tracer unit has been incorporated in the new lathe that turns between centers using power longitudinal feed or, if work is held in the face plate, using power cross feed.

Rivett Lathe & Grinder, Inc, Brighton 35, Boston, Mass

MORE DATA? Circle 71, inside back cover

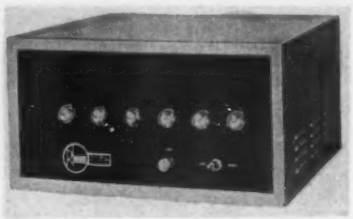
New Constant Potential Welder Offered for MIG Work

CP-750 is a 750-amp unit that has five voltage ranges with fine adjustments within each range. Applications range from light plate to heavy structural pieces.

Standard equipment includes voltmeter and ammeter, a 2-kva 115-v ac power supply with power receptacles for wire feed equipment or travel carriages, and a contractor control receptacle. A 1000-amp version, designed for automatic MIG work, is also available.

Miller Electric Mfg Co, Appleton, Wis

MORE DATA? Circle 72, inside back cover



RHEEM POSITION DISPLAY marketed as a separate unit makes possible partial automation at low cost. Used in conjunction with a position transducer geared to a leadscrew or a precision rack the display will show one, two, or more axes of motion with resolutions of 0.001 or 0.0001 in. over 999,999 in. displacement. Price of the display is $1395 for 5 decades, $1495 for 6 decades—*Rheem Mfg Co, Electronics Div, 5200 W 104th St, Los Angeles, Calif*

MORE DATA? Circle 73, inside back cover

Deburring time reduced one-half at AiResearch

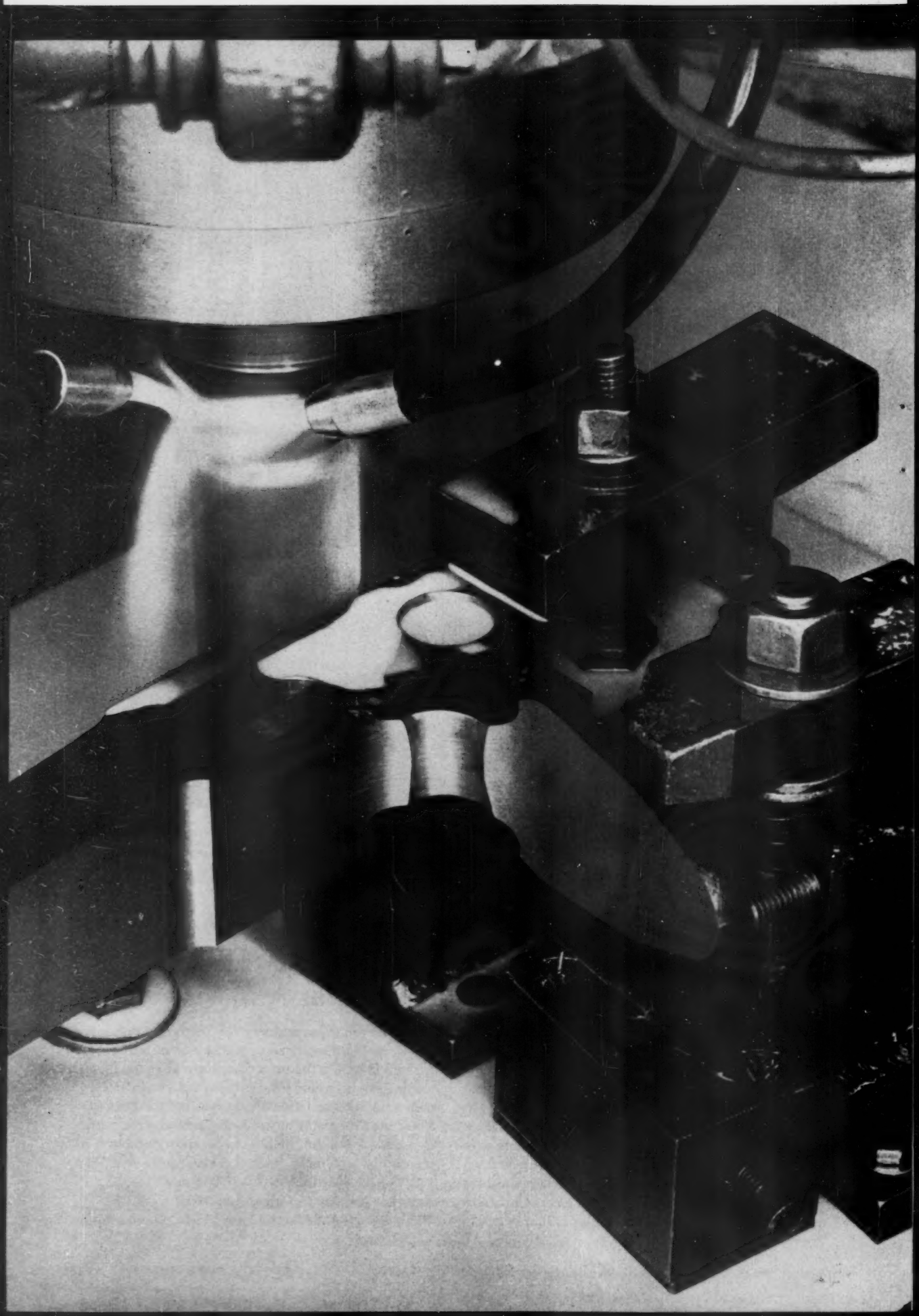
The SWECO *Vibro-Energy Finishing Mill* has reduced deburring time 50% at the Garrett Corporation's AiResearch Mfg. Div., Los Angeles. Before installing the SWECO Finishing Mill it took 10 minutes to deburr one part. Now the SWECO Mill does many parts at once. ⌘ Originally AiResearch ordered two SWECO Finishing Mills. After checking results, four more were ordered. ⌘ AiResearch manufactures precision aircraft, missile and other military equipment where finishing is highly important. SWECO'S Vibro-Energy principle produces a controlled, consistent product, with all surfaces, even edges and recesses, uniformly finished. The open-top design makes it easier to inspect parts without stopping the unit. Cleaning and changing of media have been simplified because unlike other mills which have to be tilted for unloading, the SWECO Finishing Mill practically unloads itself when the plug is pulled. ⌘ For full details, application data, and a laboratory test using *your* materials, write SOUTHWESTERN ENGINEERING CO., 4800 Santa Fe Ave., Los Angeles 58, Calif., Dept. 76381.

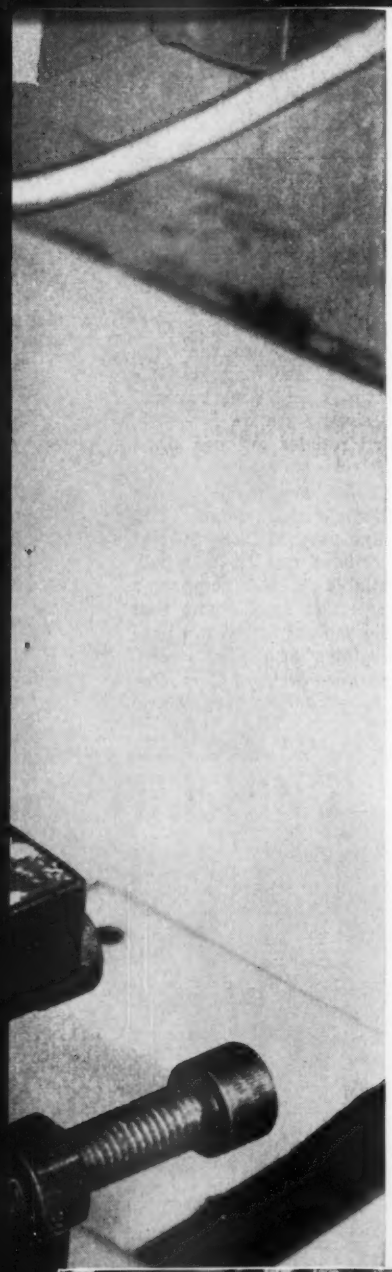
SWECO

*Vibro-Energy*finishing mills, separators, grinding mills*

* TM SEC

See our exhibit at the Detroit Metal Show, Oct. 23-27





New Univac Numerical Control System saves Rohr Aircraft up to 66% on machining costs

Less than four years ago, Rohr Aircraft had only one numerically controlled machine tool. Today, Rohr has nine—with numerical control data prepared by a UNIVAC® Solid-State Computer.

Rohr programmers simply describe in mathematical terms the shapes they want machined on a specific machine tool and the UNIVAC Solid-State automatically generates the control instructions that will guide the tool. *Result:* Thousands of metal parts of varied complexity turned out perfectly—and *economically*.

An aluminum upper engine mount, for instance, under conventional machine tooling, used to show a heavy scrap rate. Under numerical control with the UNIVAC Solid-State Computer, the scrap rate is now *zero*.

In one case, a three-dimensionally defined part was produced under numerical control at 1/40th the cost under conventional machining.

Rohr's over-all savings are as much as three to one, a saving of up to 66% on machining costs!

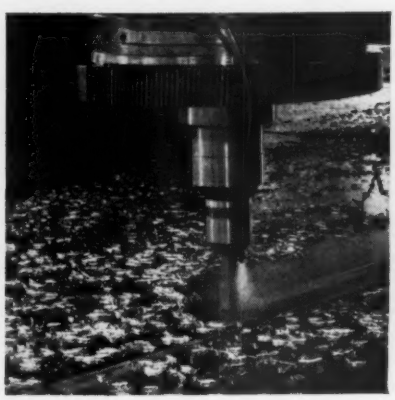
Here's what H. C. Emerson, Rohr Manufacturing Engineering Manager, has to say about the UNIVAC Solid-State Computer: "We chose the UNIVAC Solid-State because of its high storage capacity, fast processing speeds, low costs, availability and versatility. It not only handles our corporate data processing, but its application to numerical control has been extremely successful."

Yes, what's important to all industrial executives is that Univac offers a low-cost, medium scale, general purpose system that not only has proved itself in over 300 commercial installations but, at no additional cost, can handle with ease highly diversified numerical control part programs. Interested? Our local representative will gladly brief you on Univac Numerical Control—for your own installation or through your nearest Univac Service Center.

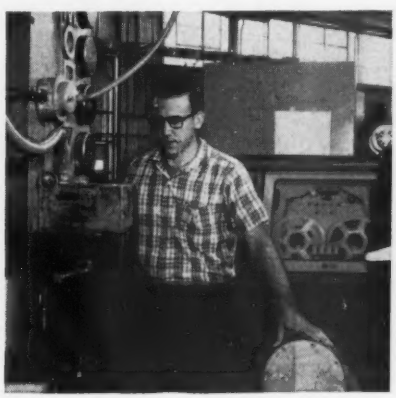
UNIVAC

DIVISION OF SPERRY RAND CORPORATION

UNIVAC Solid-State controls machining of three dimensional blowout door frame and engine mounting longerons.



Engine mounting box-beam for aircraft, milled from structural steel with help of UNIVAC Solid-State Computer.



Vacuum chuck being milled from aluminum plate with UNIVAC Solid-State produced data.

CIRCLE 342 READER SERVICE CARD

Portable Fluorescent Detector Spots Cracks in Most Materials

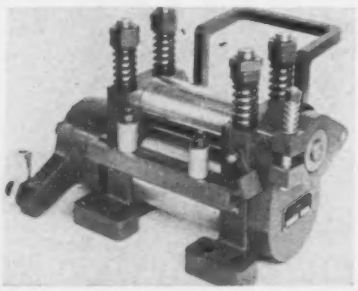
Called the Seal-Lock fluorescent detector, this inspection aid can find minute hair-line cracks and leaks in such materials as aluminum, copper, plastics, stainless steel, and other ferrous or non-ferrous solids. It uses only water soluble materials that are easily and completely removed with a simple water rinse or bath.

In most cases, complete inspection time takes only from three to five minutes. This rapid penetrating and developing rate is claimed to cut inspection time by up to 80%.

The detector can be used with any existing black light source, or with the B-100 black light unit contained in the Seal-Lock FD-100 kit.

U S Casting Repair Corp, 6432 Edmund St, Philadelphia 35, Pa

MORE DATA? Circle 74, inside back cover



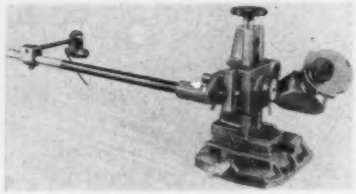
Egan Line of Roll Feeds Are Capable of Speeds up to 500 spm

Model 40-6 roll feed handles six-in. widths at thicknesses up to 0.125 in. and is capable of speeds up to 500 spm. It is one of a line of roll feeds that are available in widths of 4, 6, 8, 10, 12, and 15 in. with feed lengths of 0 to 3 in. or 0 to 9 in.

Backlash on these rollfeeds is minimized with an adjustable tension brake mounted on the upper roll. Other features are: a heavy-duty precision clutch; precision four-post die set construction with four tension springs; center-actuated roll release with automatic lockout; adjustable stock guides; and reversible drive and mounting.

Frank W Egan & Co, Somerville, NJ

MORE DATA? Circle 75, inside back cover



Optical Attachment Provides Visual Control in Grinding

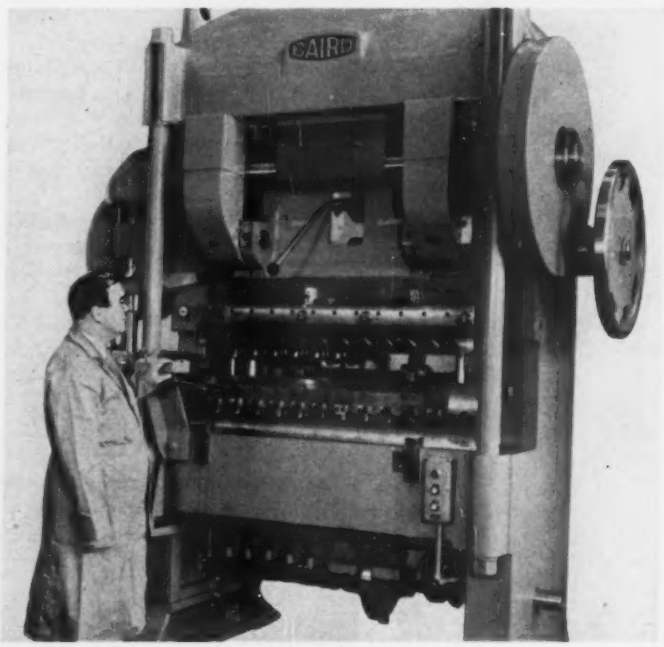
British-made Profiloscope which provides continuous optical inspection through all stages of form grinding is an independent optical unit that can be attached to standard surface and cylindrical grinders already in use. Its use makes possible control of irregular and intricate forms that could previously be ground only on special machines.

It consists of a microscopic eyepiece through which are seen the wheel and workpiece magnified 25, 50, or 100 times and superimposed over the desired form on a reticle. Six standard reticles are contained in a rotating turrent head on the instrument. They are marked with male and female radii, angles, and horizontal and vertical lines. Special full form reticles can be supplied.

Also available is the company's Projectorscope, an instrument that performs the same function but projects the readings on a large screen.

Dist by Parker-Hartford Corp, Optical Div, 650 Franklin Ave, Hartford, Conn

MORE DATA? Circle 76, inside back cover



Baird Transfer Press With Longer Stroke Produces Deep Drawn Parts at 90 per min

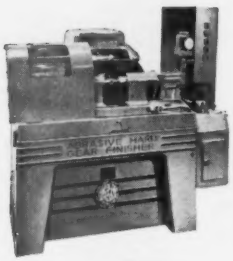
New longer stroke that permits high production of deep drawn parts such as pen caps or lipstick covers is the outstanding design feature of the Model 5L transfer press. Rated working pressure is 40 tons and standard ram stroke is 7 in. With a maximum depth of draw up to 3 in. and working die space of 51 in. the press can produce deep drawn brass parts at rates up to 90 per minute.

The press offers the choice of 9, 10, 11, 12, or 14, station die sets. Maximum blank diameter of the 9 station die set is 3½ in., maximum blank diameter of the 14 station die set is 2¼ in.

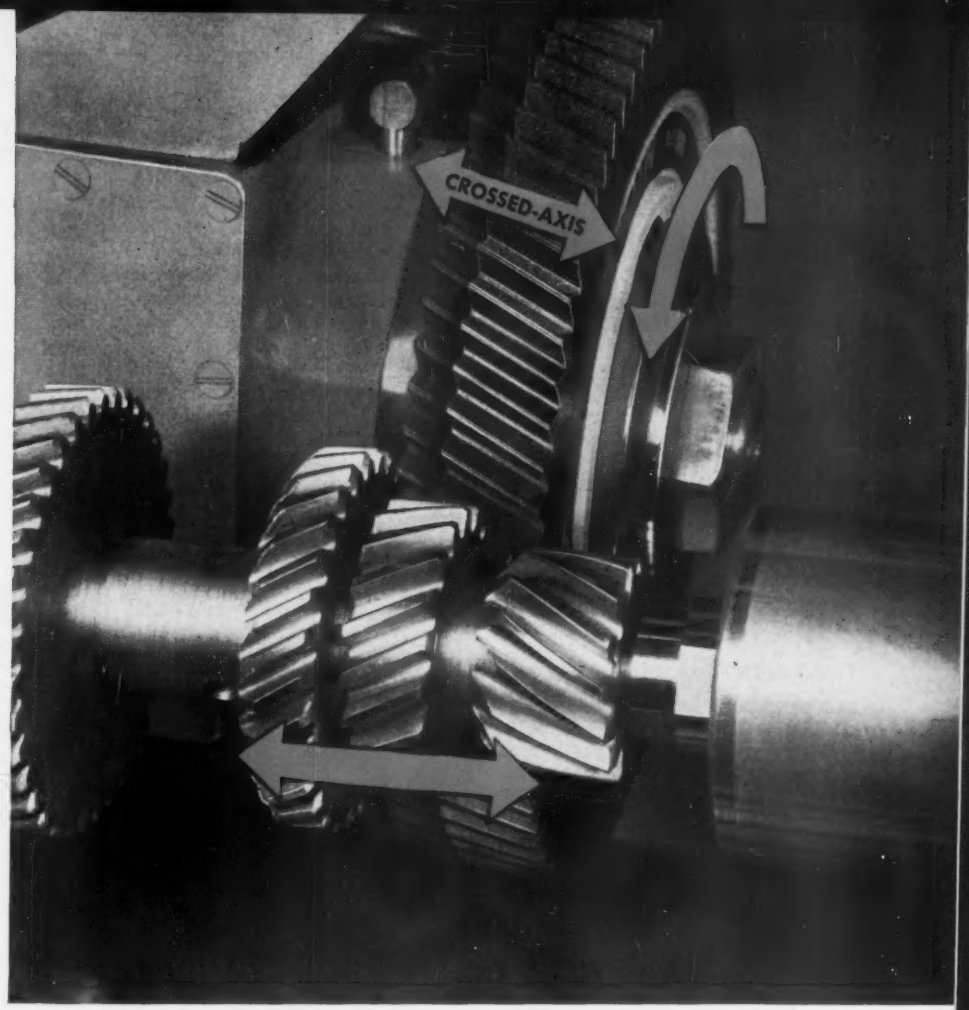
The Baird Machine Co, 1700 Stratford Ave, Stratford, Conn

MORE DATA? Circle 77, inside back cover

NEW



FOUR-MOTION GEAR FINISHING PROCESS GIVES...



TRUE HONING ACTION!

Smooth hone may be used to finish OD's in certain applications.

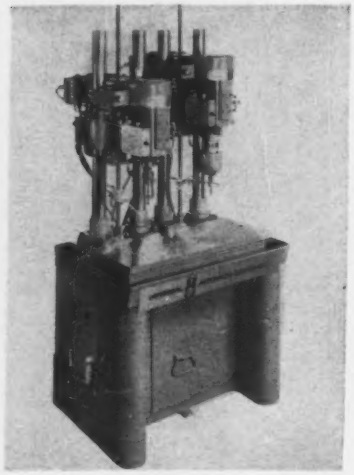
The new Michigan 999-A Abrasive Hard Gear Finisher uses four separate but integrated motions to give better surface finish on hardened gears and cylindrical parts. Nicks, burrs, some errors in lead and runout, involute, etc. are quickly corrected with newly developed hones of high-strength plastic available in a wide range of abrasives.

The hone (1) oscillates axially at high speed while (2) the work is reciprocated across the hone, (3) the gear is rotated—under controlled pressure—in mesh with the hone causing (4) sliding action due to crossed-axis of work and hone. This "Four-Motion" process results in smoother, quieter running parts.

Independently variable speeds and up to 25° hone head swivel will accommodate a wide variety of workpieces. Crowning-taper attachment, automatic loader, internal gear attachment and tool dresser are available as optional equipment. For full details write for Bulletin 999-A.

A head modification kit to convert Michigan Model 999 to the new process is available.

MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN



Two-Spindle Vertical Machine Has Independently Adjustable Heads

With each head designed as a self-contained unit, this dual-spindle vertical machine eliminates the need for riser blocks of different heights when drilling and tapping. Instead the heads are independently adjusted for height (0 to 24 in. spindle nose to table). The machine also has a pre-wired control circuit that gives independent operation of the heads and easy interlocking for use with automatic fixtures.

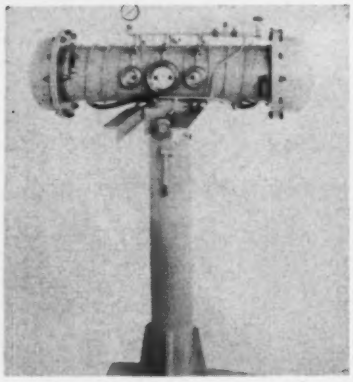
Each unit has a ¾ hp motor with a speed range of 500 to 10,000 rpm and a quill-type ball bearing spindle. Spindle stroke is adjustable from 0 to 2½ in. with rapid approach, hydraulic feed control, and rapid return. Advance and retraction of the spindles is accomplished by built-in double actuating air cylinders. Capacity of the heads is ⅜ in. dia in mild steel for drilling and tapping.

The complete machine includes hydraulic feed units, adjustable top dwell units, fixture synchronizing stations and positive depth control units.

A threading spindle is also available with low pressure rotary seal, for feeding coolant through the center of the die head.

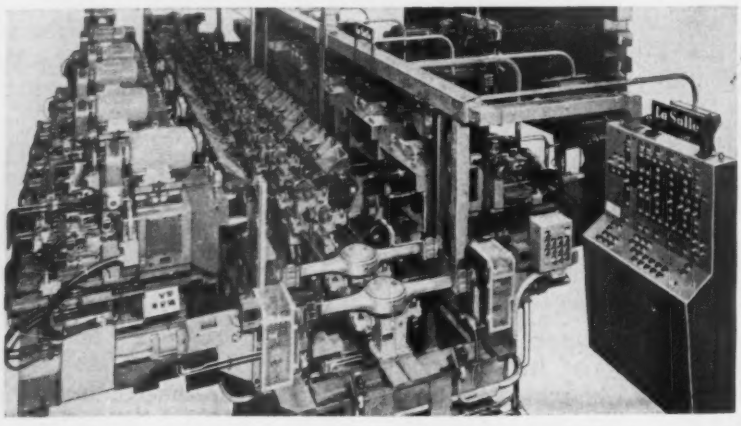
Universal-Automatic Corp, 9545 Ainslie St, Shiller Park, Ill

MORE DATA? Circle 91, inside back cover



GRAPHITE TUBE FURNACE will heat up to 5,500 F throughout the center ten inches of the heating element with variations in temperature less than 100 degrees from the average. The 30-in. long graphite element works in an inert atmosphere on a 1500-amp 15-volt power source—*Temptron, Inc, 7030 Darby Ave, Reseda, Calif*

MORE DATA? Circle 92, inside back cover



NINE-STATION IN-LINE transfer machine processes rear axle housing assemblies in multiples of two at a production rate of 200 parts an hour. Machine is built entirely from company's building block machine components—*LaSalle Machine Tool Inc, 21535 Hoover Rd, Warren, Mich*

MORE DATA? Circle 93, inside back cover

ASARCON

DISTRIBUTORS for ASARCON CONTINUOUS-CAST BRONZE:

ALABAMA
Birmingham
Dixie Bronze Co., Inc.
FA-4-4588
J. M. Tull Metal & Supply Co., Inc.
FAIRFAX 3-1612
ARKANSAS
Little Rock
Arkansas Foundry Company
FRANKLIN 2-6261
CALIFORNIA
Los Angeles
Kingwell Bros., Ltd.
LUDLOW 2-7427
San Francisco
Kingwell Bros., Ltd.
SUTTER 1-0514
CONNECTICUT
Guilford
Knapp Foundry Co., Inc.
GLENDALE 3-2744
Seymour
The Derby Castings Co.
TUXEDO 8-2581
Stratford
The Elitsworth Industrial Supply Co.
EDISON 7-3317
FLORIDA
Jacksonville
J. M. Tull Metal & Supply Co., Inc.
EVERGREEN 7-5561
Miami
J. M. Tull Metal & Supply Co., Inc.
OX 6-0150
Tampa
J. M. Tull Metal & Supply Co., Inc.
TAMPA 3-6741
GEORGIA
Atlanta
J. M. Tull Metal & Supply Co., Inc.
JACKSON 5-3871
ILLINOIS
Chicago
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
ESTEBROOK 9-0300
Bronze Bearings, Inc.
JUNIPER 3-1100
Peoria
Ray M. Ring Bearing Co.
PEORIA 6-73-8171
Rockford
Rockford Tool & Transmission Co.
ROCKFORD 2-7711
Waukegan
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
MA 3-5212
INDIANA
East Chicago
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
E. CHICAGO EX 7-8020
SAGINAW 1-8660
Indianapolis
Jones & Laughlin Warehouse Div.
Jones & Laughlin Steel Corp.
MELROSE 1-8311
South Bend
Powell Tool Supply, Inc.
ATLANTIC 9-5578
KENTUCKY
Louisville
Williams & Co., Inc.
JUNIPER 3-7781
LOUISIANA
New Orleans
Standard Brass & Mfg. Co.
AUDUBON 1381
Shreveport
Standard Brass & Mfg. Co.
UN 5-4241
MARYLAND
Baltimore
Bronze Specialties, Inc.
LEXINGTON 9-1906
MASSACHUSETTS
Boston
Keico Metal Products Co.
HUBBARD 2-1733
Millard Brass & Copper Co.
HIGHLANDS 2-6220
MICHIGAN
Detroit
Copper & Brass Sales, Inc.
FOREST 6-6200
Meier Brass & Aluminum Co.
JORDAN 6-3902
Grand Rapids
Copper & Brass Sales, Inc.
EMPIRE 1-6681
Kalamazoo
Bard Tool and Equipment Co.
FIRESIDE 3-2691
Lansing
Superior Brass & Aluminum Co.
IV 2-2754
Muskegon
Towne Hardware & Supply Co.
2-2681
MINNESOTA
Minneapolis
R. G. Eide, Inc.
FE 8-4846
MISSOURI
Kansas City
Associated Bearings Co.
HARRISON 1-0407
St. Louis
R. J. Bearing Co.
MISSION 7-3625
NEBRASKA
Grand Island
The Island Supply Co.
DUPONT 2-8567
Omaha
T. S. McShane Co., Inc.
JACKSON 1273
NEW JERSEY
Carlstadt
E. A. Williams & Son
GENEVA 8-0800
MARKET 3-1329
(New York LA 4-9545)
Newark
Federal Bronze Products, Inc.
MARKET 2-6380
Perth Amboy
Gregg's Brass Foundry
HILLCREST 2-2086
NEW YORK
Brooklyn
Hamsley, Inc.
STerling 8-1144
Buffalo
Kencroft Associates, Inc.
RIVERSIDE 1520
Rochester
Ontario Metal Supply, Inc.
HAMILTON 6-1638
Syracuse
Meloon Bronze Foundry, Inc.
GLENVIEW 4-3231
Troy
The Troy Belting & Supply Co., Inc.
AS 2-4920 (in Albany 3-6121)
OHIO
Akron
Akron Welding and Spring Co.
JEFFERSON 5-2187
Cleveland
Copper & Brass Sales, Inc.
VU 3-8100
The Bearing Bronze Co.
MICHIGAN 1-6520
Cincinnati
Reliable Castings Corp.
KIRBY 1-2627
Columbus
Williams & Co., Inc.
AXMINSTER 4-1623
Dayton
The Bristol Brass Corp. of Ohio
BALDWIN 8-8185
Toledo
The Seegar Brass Company
CHERRY 8-5321
Williams & Co., Inc.
GREENWOOD 5-8661
PENNSYLVANIA
Easton
R. T. Schaller Co.
BL 2-2435
Latrobe
Latrobe Foundry Machine & Supply Co.
KEYSTONE 7-3341
Philadelphia
Brass & Copper Sales, Inc.
GLADSTONE 7-2500
Renewal Service, Inc.
BALDWIN 9-6330
Pittsburgh
Pennsylvania Industrial Supplies Co., Inc.
ALLEGHENY 1-5010
Pittsburgh Brass Mfg. Co.
ATLANTIC 1-8761
RHODE ISLAND
Providence
Clifford Metal Sales Co., Inc.
UNION 1-4100
SOUTH CAROLINA
Greenville
J. M. Tull Metal & Supply Co., Inc.
CEDAR 3-8356
TENNESSEE
Memphis
Memphis Bearing & Supply Co.
JACKSON 6-7543
Nashville
Dixie Bearings, Inc.
CHAPEL 2-7351
TEXAS
Beaumont
Standard Brass & Mfg. Co.
TERMINAL 3-2541
Houston
Standard Brass & Mfg. Co.
HI 7-1220
Port Arthur
Standard Brass & Mfg. Co.
YUKON 5-9377
WISCONSIN
Milwaukee
Badger Bearing Co.
BROADWAY 2-0231
CANADA
Lachine, Quebec
Federated Metals Canada, Ltd.
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PLYMOUTH 7-3245

ASARCON

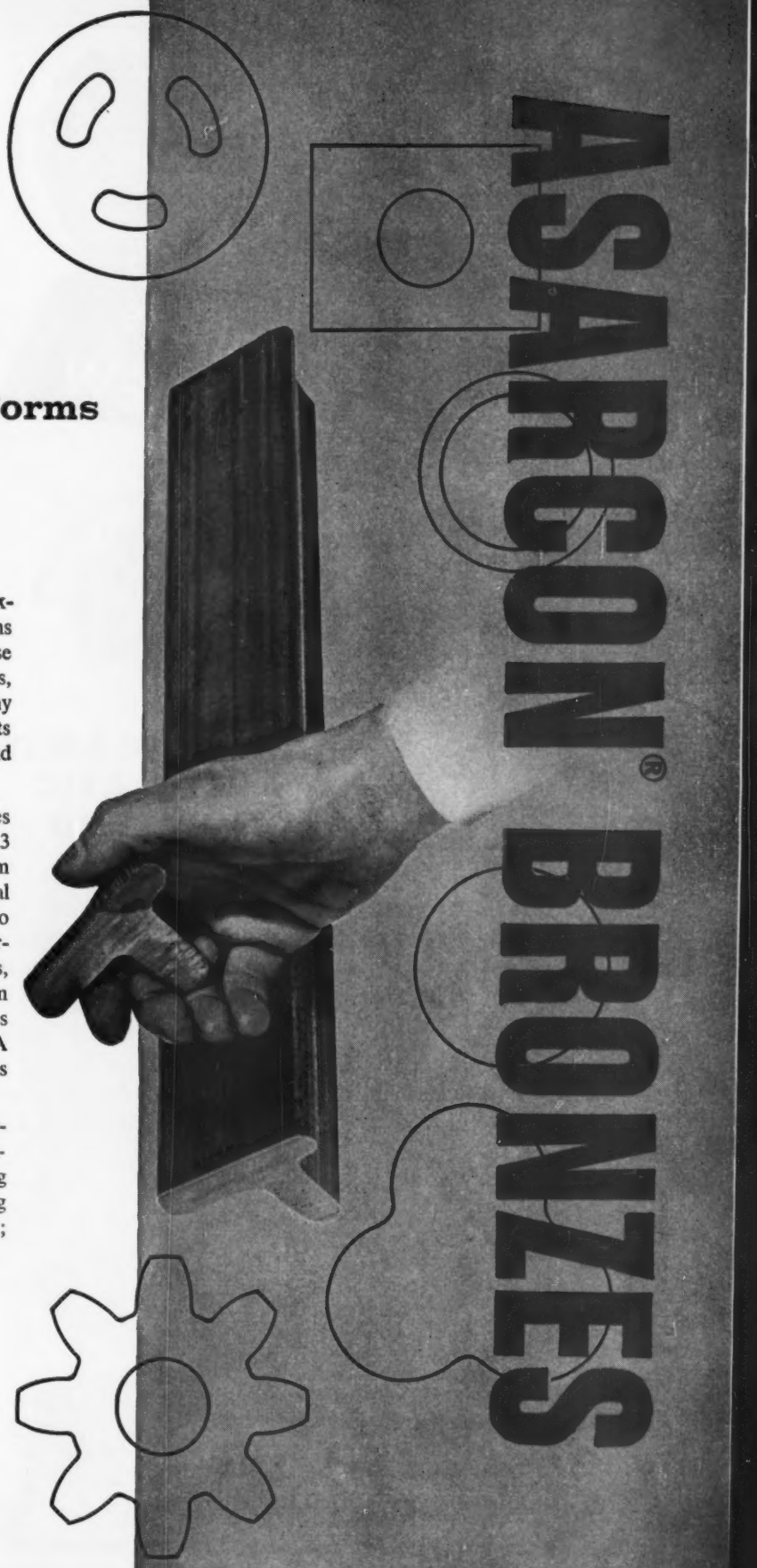
custom shapes and forms in any lengths you need

Asarcon continuous castings give you an extremely wide variety of shapes and forms in standard bronze alloys. They will increase your production rates and lower your costs, because: you get the shape you want in any length you need up to 20 feet. This permits machining on automatic screw machines and other high-speed equipment.

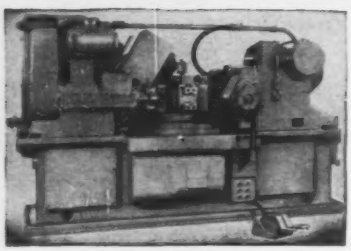
Continuous casting of Asarcon bronzes raises fatigue characteristics of standard alloys 33 to 100%, increases impact strength from 15% to more than double that of identical alloys cast other ways, adds materially to tensile, yield strengths and hardness. Asarcon 773 (SAE 660) bearing bronze in solids, rods and tubes is immediately available from stock in your choice of more than 260 sizes up to 9″ O.D. and lengths up to 105″. A wide variety of other special alloys, shapes and sizes produced to order.

For complete data on Asarcon continuous-cast bronze, write Continuous-Cast Department, American Smelting and Refining Company, Perth Amboy, N. J.; Whiting Ind., or 120 Broadway, New York 5, N. Y.; or call your nearby Asarcon distributor.

ASARCO



CIRCLE 345 READER SERVICE CARD



GOSS and DE LEEUW
AUTOMATIC
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

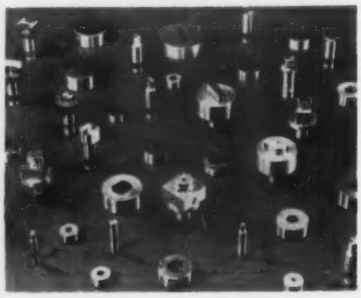
The basic "1-2-3" method . . . exclusive with Goss & De Leeuw . . . provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT



Di-Acro Expands Line of Special Purpose Dies and Punches

Expanded line of special purpose punches and dies for electrical and electronic punching includes D and double D shapes, hexagon cutouts, electrical outlet knockout, keyhole, keyway, trim and cutoff and corner rounding styles. Total of off-the-shelf-sizes is now more than 500.

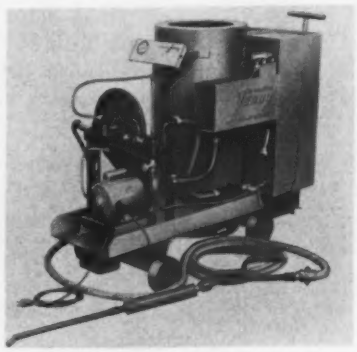
The cutting edge of these punches are ground so that the point is concentric to the shank within 0.0005 in. This is said to save setup time because it permits accurate alignment of holes when using punches ⅛ in. and up.

Punches 13/16 in. and larger that require more than 4 tons to punch 16-gage steel are ground with a twin shear that reduces necessary power 50%, according to the manufacturer. They can also be supplied without the twin shear for blanking.

Adapters are available for fitting the sets to all hand and power punches now on the market.

Di-Acro Corp, Lake City, Minn

MORE DATA? Circle 94, inside back cover



Steam Cleaner Features 100-gph Pump Capacity

The 750 Series Hypressure Jenny steam cleaner incorporates a newly designed angle grip swivel cleaning gun with high-impact nozzle which blasts away grease and dirt; solution metering controls; and automatic electric spark ignition.

Optional features and accessories

include nozzle control for remote operation; low water cutoff to automatically stop unit in case of water supply failure; cooling system cleaning attachment for reverse flushing automotive cooling systems; choice of oil or gas burner. Furnished in portable and stationary models, it is 48½ in. long, 22 in. wide, 38 in. high, weighs approximately 340 lb.

Homestead Valve Mfg Co, PO Box 348, Coraopolis, Pa

MORE DATA? Circle 95, inside back cover

Lightweight Plasma Gun Offered For Production-Line Use

Entire gun, which is 5 in. long and weighs 3½ lb, assembles with only four bolts securing self-aligning, piloted parts. The PG-100 PlasmaGun will spray coatings, including refractories, with a controlled thickness, density, and bond strength that reportedly could never be obtained before.

Manufacturer states that a coating is deposited at twice the rate of comparable competitive models, and at savings up to 30% over existing coating processes such as oxy-acetylene flame-spraying. The gun can also be used to fabricate free-standing forms more economically than by traditional methods.

Model has integral adjustable cathode control. High regulation of powder feed by an electromechanical system using a vernier control permits the use of powders that previously were too fine for plasma guns. Complete PlasmaGun System offered includes the gun, control console with self-contained powder feed, a power supply, and spray booth.

Avco Corp, Research & Advanced Development Div, 201 Lowell St, Wilmington, Mass

MORE DATA? Circle 96, inside back cover

CHICAGO® PRESS BRAKES

unexcelled accuracy / *for sheet metal and plate work*

Model 410D, 90-Ton CHICAGO Mechanical Press Brake. Other standard sizes from 11 to 450 ton capacities.

Model 600H10, 600-Ton CHICAGO Hydraulic Press Brake. Other standard sizes from 300 to 2000 ton capacities.

Complete details or recommendations on any press brake work upon request

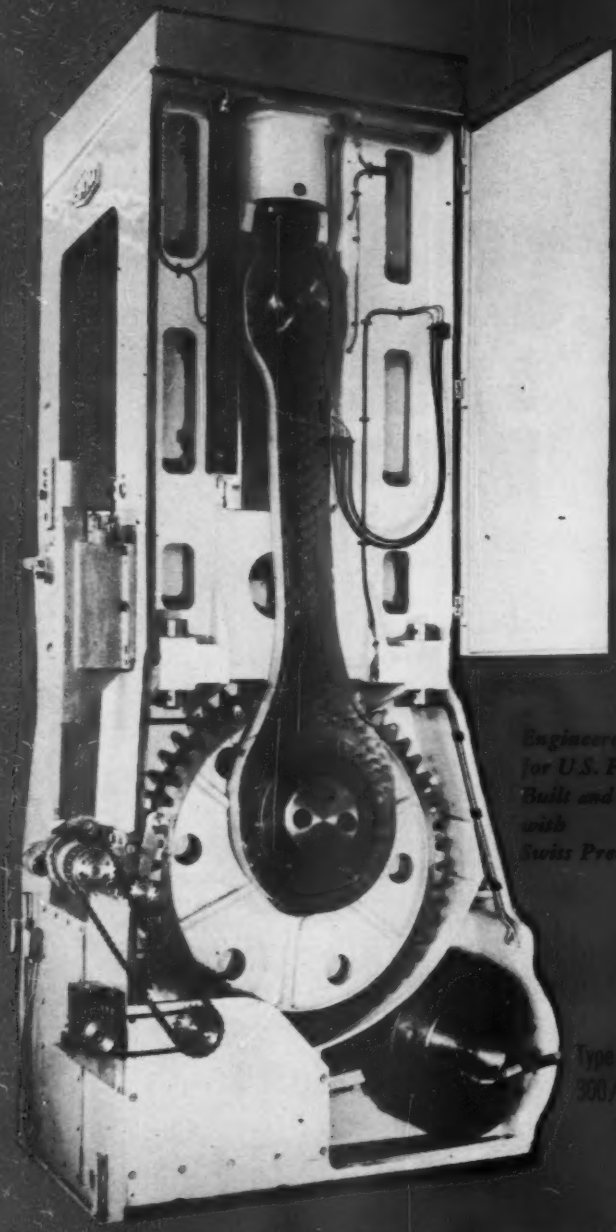
8439

Press Brakes
Press Brake Dies
Straight-Side-Type Presses
Hand and Power Bending Brakes
Special Forming Machines

CHICAGO DREIS & KRUMP

DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

COLD FLOWING BY MAYPRES



Engineered for U.S. Production. Built and Serviced with Swiss Precision!

Type MKR 300/20-32

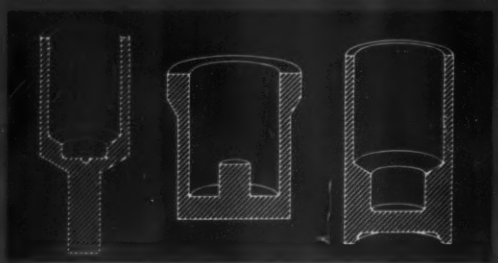
Type MKR 1-63/1

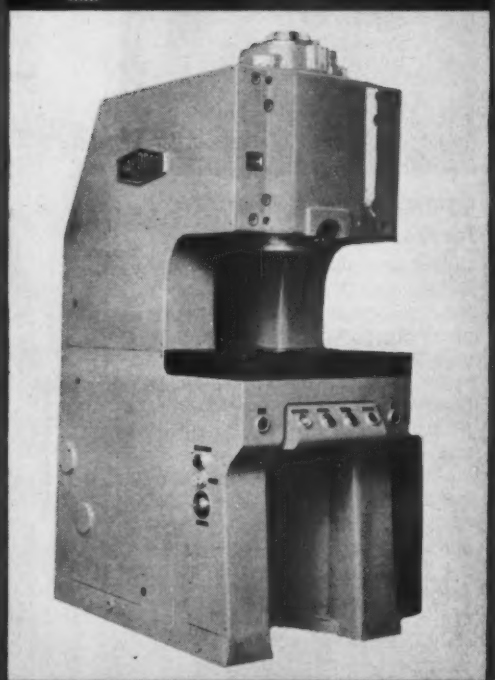
Especially designed and developed

TO COLD IMPACT EXTRUDE

steel, copper, aluminum and allied alloys.

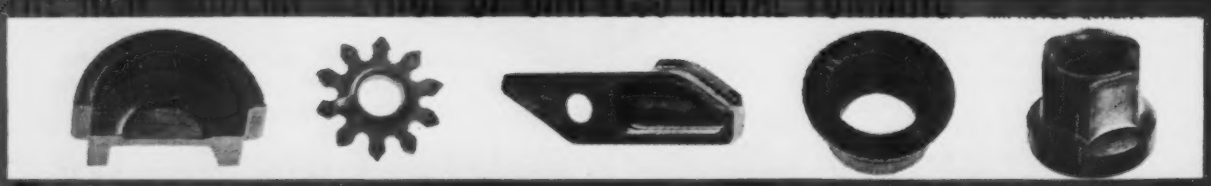
Increases tool life . . . offers top and bottom knock-out . . . better flow motion. Incorporates all the essential features needed for cold impact extrusion.





VARIOUS MODELS AVAILABLE RANGING FROM 30 TO 600 TONS

THE NEW MODERN METHOD OF CHIPLESS METAL FORMING! CUTS PRODUCTION COSTS



Exclusive U.S. Representatives

THE ARTHUR LOEFFEL COMPANY, INC.

MERRICK, N.Y. • TEL. FREEPORT 9-8600 Offices in Chicago and Los Angeles

INVITATION...

2nd private showing...

You are invited to attend

A WORKING EXHIBITION
OF SWISS MACHINE TOOLS

in operation
on Typical American Production Work
at the showrooms of
The Arthur Loeffel Company Inc.
47 East Fulton Ave., Roosevelt, L. I., N. Y.
Oct. 23 through Oct. 31, 1961
9 a.m. to 7 p.m. daily, Sat. 9 a.m. to 3 p.m.

FEATURING

PETERMANN
Swiss automatic screw machines—full line

TAREX
bar and chucking machines

EBOSA
cam-controlled turning and thread-chasing machine

MAYPRES
cold-impact extrusion presses—63- and 300-ton models

SIMONET
bench-type toolmaker and hand-operated 2nd operation lathes
... also precision machines for grinding carbide tools, edge chamfering, small-hole lead screw tapping and drill grinding etc

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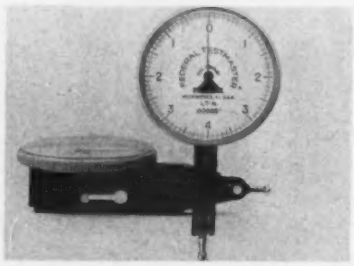
NEW SHOP EQUIPMENT



Supersensitive Test Indicators Furnished in Two Dial Sizes

T Series, reported to have 40% less gaging tension and 25% less friction than previous models, are available in both large (1½-in.-dia) and regular 1-in. dial styles. Inherent accuracy and sensitivity of this series makes possible the inclusion of a model graduated in fifty millionths of an inch.

Improved accuracy and sensitivity is achieved by a more responsive internal mechanism, plus the introduction of a new counterbalanced indicating hand and full-jeweled bearings throughout. Mounting dovetails are cast integrally with the case to prevent any chance of loosening while the indicator is in use.

Federal Products Corp, Providence 1, RI

MORE DATA? Circle 97, inside back cover

POWER SUPPLY FOR MIG WELDING operates on single phase lines and provides power for steel, aluminum, or alloy welding including the entire "short arc" range and "spray arc" range. Designated the model CV200, it has a rated output of 200 amperes at 35 vdc, 100% duty cycle. Open circuit voltage is 8.5 to 53 vdc on 230/460 v input. Input requirements are low (17 amp at 460 v or 34 amp at 230 v) and operation is simple; the operator presets the voltage for the job—*Glenn Pacific Corp, 703-37th Ave, Oakland 1, Calif*

MORE DATA? Circle 98, inside back cover

COSTS UP?

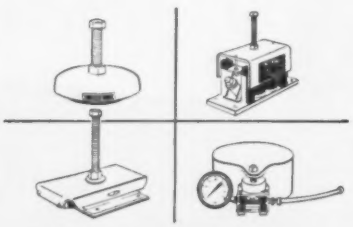
MACHINES TIED DOWN?

Plant moves, rearranging layouts, new machine installations all cost money — and the cost *is* excessive if you make a practice of lagging your production equipment to the floor.

Wouldn't it save money in your operation if you could forget about spotting, drilling, shimming, lagging and all the other costly necessities that go with tying down machinery? By using BARRYMOUNTS® you eliminate those expenses *and* repeat your savings whenever you relocate a machine.

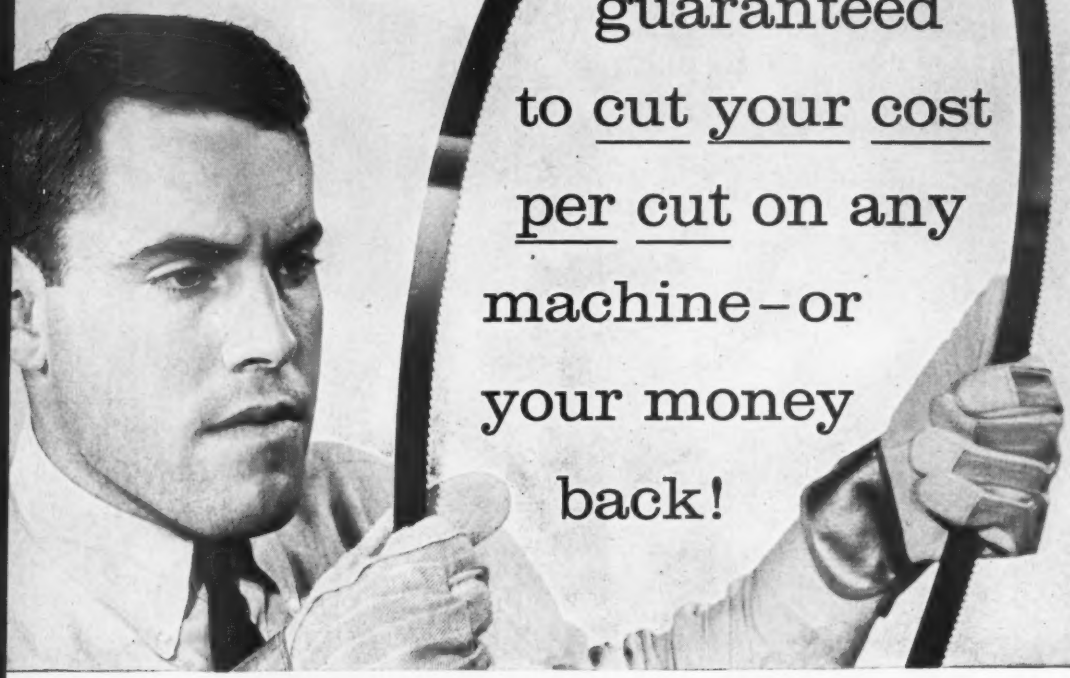
Barry offers *three* different resilient elements: neoprene, helical springs or air to solve your individual requirements. These quality-engineered Machinery Mounts not only provide the ultimate in layout flexibility — they pay big dividends too — isolating shock and vibration, improving precision, reducing machine and building maintenance. Even operator efficiency goes up as noise levels come down.

If you want to add cost-saving efficiency to your operation —look into a BARRYMOUNT® program. Write for Bulletin 60-04C, "Practical Considerations When Installing Machinery."



BARRY CONTROLS
SHOCK • VIBRATION • MACHINE EFFICIENCY
Division of Barry Wright Corporation
700 PLEASANT ST., WATERTOWN, MASS.
1400 FLOWER ST., GLENDALE, CALIF.

a DoALL PRODUCTIVITY-PLUS product



new Dart® Blade guaranteed to cut your cost per cut on any machine—or your money back!

Try it for results like these!

NOW AVAILABLE in widths, pitches, and types for every job.

Dart Precision®

3/16, 1/4, 3/8, 1/2, 5/8, 3/4, and 1-in. blade in 6, 8, 10, 12, 14, 18, 24 and 32-pitch, depending on width; raker or wave set.

Dart Buttress®

3/16, 1/4, 3/8, 1/2, 3/4, and 1-in. blades in 3, 4, and 6-pitch, depending on width.

Dart Claw Tooth®

1/4, 3/8, 1/2, 3/4, and 1-in. blade in 3, 4, and 6-pitch, depending on width.

Special introductory offer: a free lubricator for your horizontal cutoff saws with an order of 12 Dart blades and one gal. #150 cutting oil.

". . . cannot afford to be without Dart blade. Initial increased investment of 10% is returned fourfold"—Zuelzke Tool & Engineering, Milwaukee.

"200% increase in blade life; rate of cutting increased 10%; accuracy greatly improved"—The Eldred Company, Columbus, Ohio.

"Dart blade on our horizontal saw has been running over a month and still like new; never before able to use any carbon blade for two weeks . . . getting straighter cuts; longer life; no messy coolant splash with lubricator you installed"—Embassy Metal Corporation, New York City.

"Your claim of 50 to 75% greater blade life is conservative. Cutting 2½" pipe, Dart outlasts two regular blades"—Minneapolis Ornamental Iron Company, Minneapolis.

"Blade life one and a half and two times previous. Straighter cuts eliminate scrap loss and secondary operation"—Vickery Engineering Company, Indianapolis.

Dart cuts cost per cut on any vertical or horizontal machine. Call your local DoALL store today for a demonstration.

THE DoALL COMPANY, Des Plaines, Illinois
Serving you locally through your DoALL Sales-Service Store

DoALL . . . the Productivity People

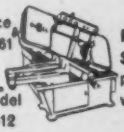
CIRCLE 352 READER SERVICE CARD

CALL YOUR DoALL SALES-SERVICE STORE

MACHINE TOOLS

Price $10,336 — Rent $66.21 per week
Model 2613-3
Contour-matic
23 models available
BAND MACHINES

Price $1475 — Rent $9.46 per week
Model DH-612
6" x 12"
12 models available
SURFACE GRINDERS



Price $2761 — Rent $17.70 per week
Model C-12
6 models available
POWER SAWS

CUTTING TOOLS

18 types
All sizes

MEASURING INSTRUMENTS

Shop blocks $130

50 sets available

Price $80
18" x 24"
All sizes • grades

SHOP SUPPLIES

For Every Purpose

2,000 Sizes • grades

Find Your DoALL STORE in The "Yellow Pages"

Chrome
Plated
Steel

This mark tells you a product is made of modern, dependable Steel.

How a "specially tailored" strip reduces production rejects almost 25% for Kromex

Kromex, Inc., Cleveland, Ohio, turns out a complete line of pantry ware, but they were having trouble with a square, mirror-finish chromium-plated cake cover that was made with a single deep draw. Rejection rate was a stunning 25%. They first tried a No. 3 finish for this application, but because of the very deep draw and the dense and smooth surface, satisfactory lubrication was near impossible. The result: Excessive draw marks and breakage. A regular No. 2 finish was then tried. The draw was successful. But buffing and finishing costs were prohibitive for this application.

American Steel and Wire salesmen conferred with our Metallurgical Department and suggested a specially tailored No. 3 finish. Reject rate dropped to less than 1% because the special surface was able to hold lubricant evenly, but smooth enough to draw and plate flawlessly.

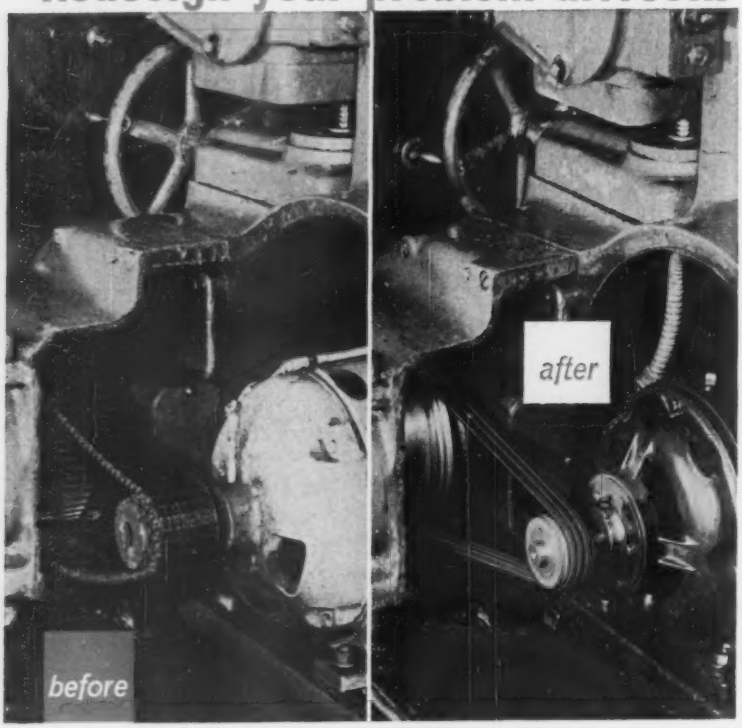
Kromex is one more example of how strip, *tailored to end use,* works to produce a better product at lower cost. When you buy strip, you're buying a specific chemistry, temper, dimension, edge and finish that is consistently uniform within the coil or from coil to coil. Certain of your processing steps may actually be eliminated by using cold rolled strip, produced in our mills, and tailor-made for your specific end use.

Take a hard look at your production line and let our salesmen and metallurgical people look too. There's a good chance you can improve quality and cut production costs at the same time with *tailored-to-the-job* cold rolled strip from American Steel and Wire. American Steel and Wire Division, Rockefeller Bldg., Cleveland 13, Ohio. *USS and American are registered trademarks.*

USS American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors
United States Steel Export Company, Distributors Abroad

Redesign your problem drives...



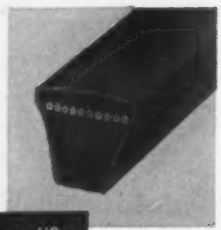
How Gates Super HC Drives are reducing drive down-time

If you have a chain, gear, flat belt or conventional V-belt drive that is causing costly production down-time or high maintenance costs, a Gates Super HC High Capacity V-Belt Drive can be your answer.

Because of exclusive changes in V-belt shape, construction and materials, a Gates Super HC Drive can handle the same power as a conventional V-belt drive in ⅔ to ½ the space—with fewer belts and smaller, lighter-weight sheaves. As a result, bearing loads are less, giving increased bearing life. Also, it is often possible to eliminate outboard bearings and jack shafts, reducing the number of elements present to cause drive down-time.

Moreover, Gates Super HC Drives absorb machine-damaging vibration and shock. Multiple belts assure you of continuous operation, further cutting costly machine down-time.

The Gates Man near you is a drive design expert. Ask your nearby Gates Distributor for his help when you have a drive problem.



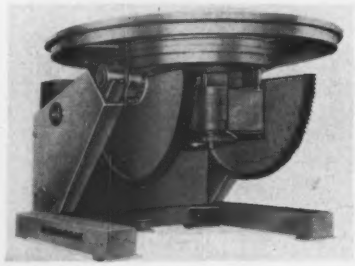
Exclusive design features include: precisely engineered Arched Top, Concave Sidewalls, Flex-Weave cover, super strength tensile construction.

Gates

Building the future on 50 years of progress

The Gates Rubber Company
Denver, Colorado BP61

Gates Super HC V-Belt Drives



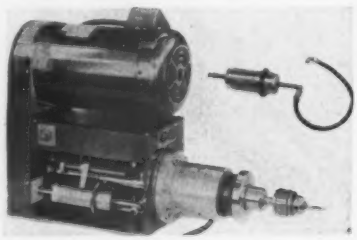
80,000-lb-Capacity Positioner Has Speed Range of 480:1

Positioner, rated 80,000 lb at 20-in. center of gravity, features 36-in. vertical adjustment with no column projection above the table top even with the table in a horizontal position.

Power-operated tilt and rotation are available through separate motors and positive gear trains. Rotation is accomplished by a 20-hp electronic variable speed drive operating in conjunction with two electrically shifting transmissions. This combination offers an unusually wide speed range of 480:1, enabling the rotation of weldments from a minimum of 2 ipm at 12 ft diameter to a maximum of 100 ipm at 16 in. diameter. Speed control by potentiometer is operated remotely. Table is 12 ft in diameter. Top plate is 3 in. thick, machined flat to ± 1/64 in. with scribe marks every 12 in. of diameter. Tilt mechanism is powered by a 15-hp brake motor through a self-locking speed reducer and double tilt segments and pinions. Tilt range is 135° forward from the horizontal.

Ransome Co, Scotch Plains, NJ

MORE DATA? Circle 99, inside back cover



Control Accessory Offered For Drill-N-Tap Units

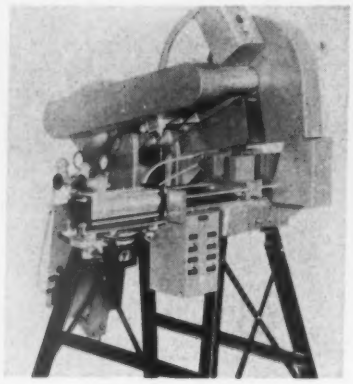
The Drill and Tap Control, designed to be attached to Series 28 Drill-N-Tap portable drilling units, permits user to drill and tap automatically in one operation with combination tools.

During the drilling portion of the stroke, the control is idle to provide maximum allowable thrust for rapid

metal removal. As the threaded section of the tool engages the work, the control cancels out a predetermined portion of the advance pressure, producing a light, tapping thrust that allows the tool to feed itself into the work without excessive tool or material stresses. Quickly adjustable, the control simplifies rapid changes in tool sizes or material. Once adjusted, it provides consistenly uniform thrusts in cycle after cycle. Advance and retract feed rates of Series 28 units can be easily adjusted to match tap lead. Two control models are available, one for single tool use, the other for use with multiple spindle attachments.

Dumore Co, 1300 Seventeenth St, Racine, Wis

MORE DATA? Circle 100, inside back cover



Beaver Abrasive Cut-off Machine Makes 1500 Cuts an Hour

Ferrous or non-ferrous tubing, extruded shapes and bars are cut to length automatically on this abrasive cutoff machine at a rate of 1500 cuts per hr.

The manufacturer says that most shapes up to 3-in. standard bar lengths and 1¼-in. solid stock can be cut with feed strokes from 3/16 to 8 in. Longer strokes can be produced with special adaptations to the machine.

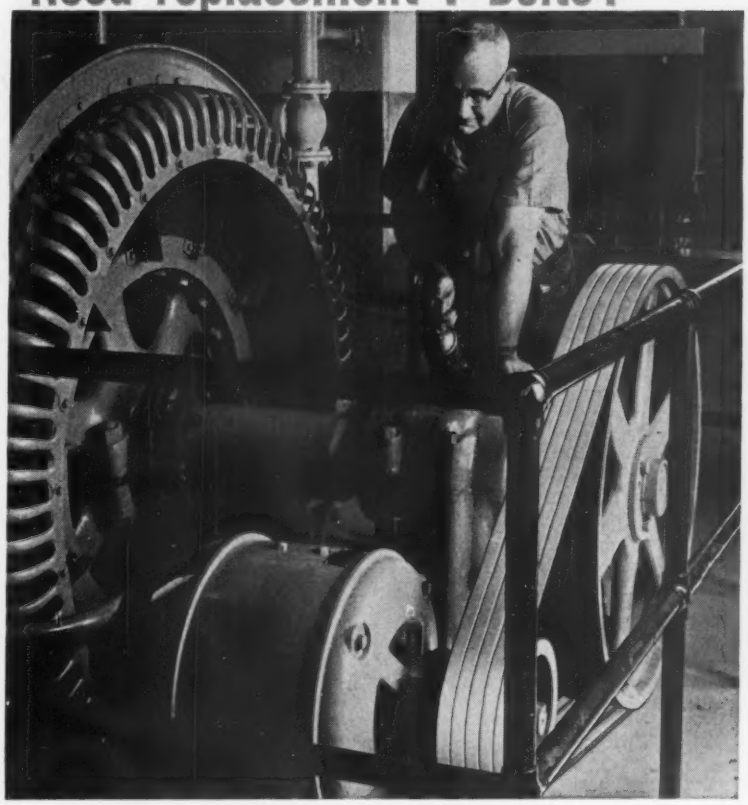
The machine, which can be set for automatic or semi-automatic cycling, is powered by a 5-hp motor. Wheel speed is 3000 rpm and wheel diameter is 14 in.

Air pressure control for cutting feed ranges adjusts the wheel pressure and is said to prolong wheel life by 30%. Operating air pressure is 10 to 100 psi and air consumption averages from 2 to 4 cu ft per min.

Beaver Pipe Tools, Inc, Warren, Ohio •

MORE DATA? Circle 101, inside back cover

Need replacement V-Belts?

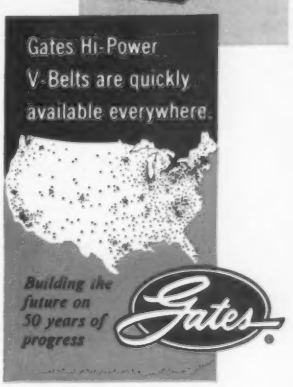


Reliability of Gates Hi-Power V-Belts makes them industry's No. 1 choice

The exclusive construction features of Gates Hi-Power V-Belts—the Concave Sides (U.S. Patent No. 1813698), the Arched Top, the Flex-Bonded Tensile Member—make them more dependable than ordinary, conventional V-belts. They give you long belt life on even the toughest applications.

Moreover, because of Gates high standards of quality control, you get a perfectly matched set of Hi-Power V-Belts every time—every belt pulls its share of the load throughout the service life of the drive, further increasing belt life.

You will get fast delivery of Hi-Power V-Belts from the local stock of your nearby Gates Distributor. Call him today.



The Gates Rubber Company
Denver, Colorado BP 60

Gates Hi-Power V-Belts

You can count on . . .

LINCOLNWELD SUBMERGED ARC WELDERS . .

Here, 16 **Lincolnweld** heads operating simultaneously make eight, 85-foot double-fillet welds which join stringers and center plate to railroad car deck plates. No other process could do this job so well, so fast.

...FOR PERFECT STARTS EVERY TIME

Photo on the left shows an expensive, fully-automated submerged arc setup with 16 welding heads. Press the button. Can you count on every arc to start perfectly? Every time? This manufacturer can. He chose **Lincolnweld** equipment. Because he knows its welding dependability, ruggedness and easy serviceability will protect his investment and guarantee production by consistently delivering good welds . . . fast . . . at low cost.

Here, single LAF **Lincolnweld** head is used to make large fillet welds on bridge sections at speeds not possible by any other process. Note conveniently-mounted controls which let operator govern process at all times. No involved electronic circuitry to get out of order. Components are easily serviced by shop electricians. Lincoln automatic submerged arc heads are made for AC or DC welding, in shop or in the field; can be used singly or in various combinations to get higher speeds, lower-cost welds.

For short production runs, manual **Lincolnweld** gives you the benefits of submerged arc welding . . . continuous wire feed, high speeds and deep penetration . . . without the expense of fixturing. Here, ML-3 gun, propelled at pre-set speed by serrated wheel resting on work, provides a degree of mechanization and control not possible with manual welding.

Parts with unusual configurations were once welded exclusively by stick electrodes. Now, however, you can take advantage of submerged arc welding even on these kinds of joints with the ML-3 or the ML-2 shown here because of their inherent versatility. Result? Higher speeds, lower costs, better quality . . . at low initial capital outlays. See **Lincolnweld** submerged arc equipment in action. Contact your local Lincoln field engineer, a specialist in welding. Or, write for information on this equipment now.

THE LINCOLN ELECTRIC COMPANY • DEPT. 1651 • CLEVELAND 17, OHIO

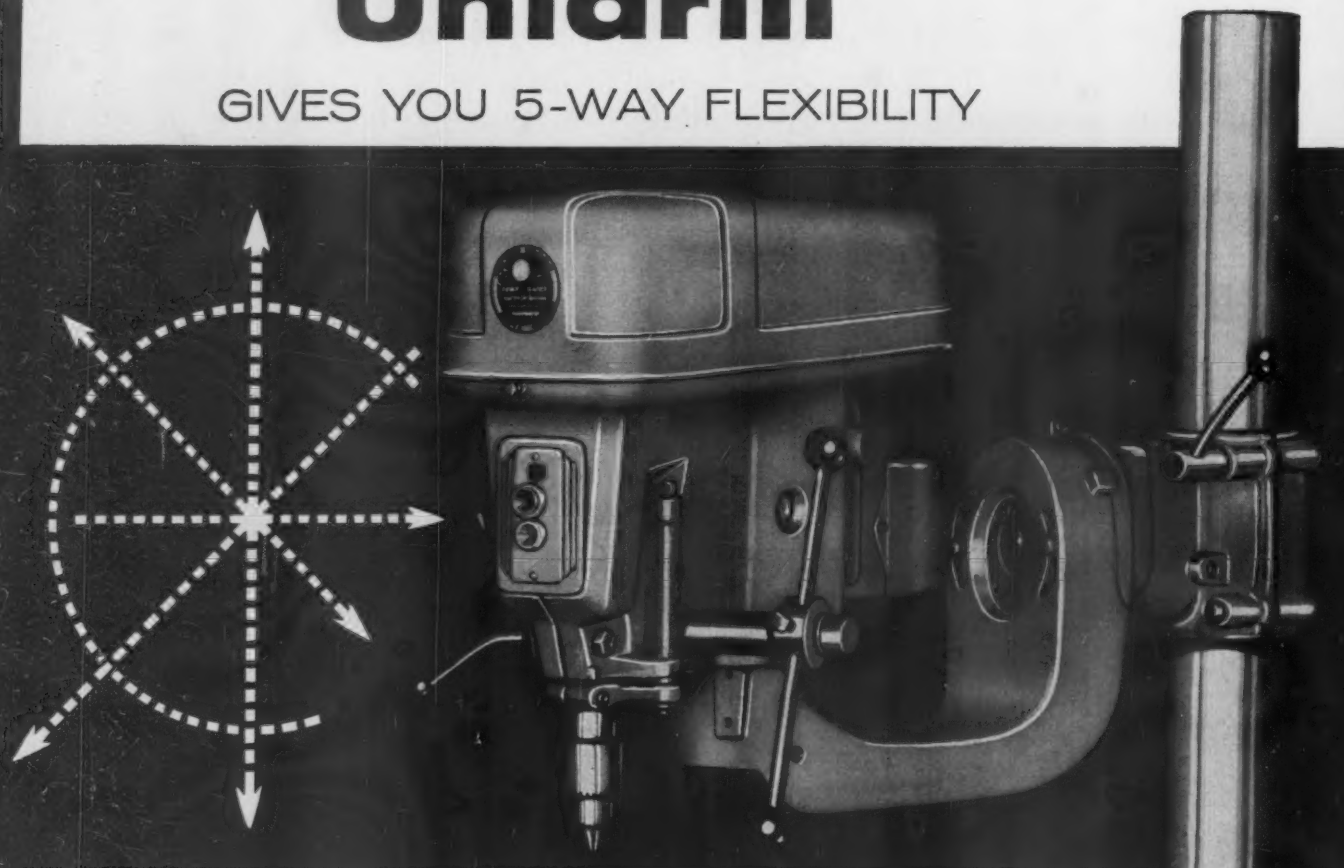
LINCOLN WELDERS

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

CIRCLE 358 READER SERVICE CARD

NEW Walker-Turner Unidrill*

GIVES YOU 5-WAY FLEXIBILITY



With the Unidrill you can position the cutting tool to the work in five different ways—move and tilt the drill head to speed the operation, reduce set-up time and eliminate expensive jigs. It's a 2-foot arm radial drill press designed to handle problem drilling jobs—angular drilling, heavy work, bulky pieces requiring extra throat capacity or "reach" of the arm.

You can do reaming, spot facing, counterboring and many other jobs. The Unidrill offers six interchangeable spindles or spindle adapters plus a 12-speed multi-speed attachment that provide even greater versatility.

Ask your Walker-Turner Distributor (listed under MACHINE TOOLS or TOOLS in the Yellow Pages) to show you how the Unidrill can drill to the center of a 48" circle. With one demonstration of this flexibility in action, you'll learn why more people in metalworking call Walker-Turner the *value line*.

FREE BROCHURE shows the full Unidrill line available in floor and bench models with: Utility or Deluxe Head, High or Slo Speed, Key Chuck or Tapered Spindle. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WK-21, 400 N. Lexington Ave., Pittsburgh 8, Pa.

**Trademark*

WALKER-TURNER
"LIGHT HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

CIRCLE 359 READER SERVICE CARD

Swiss Machine Tools To Be Exhibited in NY

Arthur Loeffel Co, Merrick, Long Island, NY, will hold its Second Open House showing of Swiss precision machine tools for which it is the US representative. All machines will be exhibited in operation under shop conditions on typical American production work. Show dates are Oct 23 through Oct 31.

Among the machines that'll be exhibited are Petermann Swiss automatics; Tarex automatic bar and chucking machines; Ebosa secondary operation cam-controlled turning and thread chasing machine; Maypres cold impact extrusion presses; Simonet precision bench-type toolmakers and hand-operated second operations lathes.

Ford Motor Planning To Take Over Philco

Philco Corp, based in Philadelphia, will be acquired by Ford Motor Co in an exchange of stock that would involve about $100 million. Deal would make Ford competitive with General Motors in the space and defense fields as well as in home appliances; transaction is subject to approval of Philco shareholders. Philco would become a wholly owned subsidiary of Ford which plans to continue the business activities of the company without interruption. Whether the Philco name and all of its home appliance products would be continued under their present brand names has not yet been determined.

$20 Million Orders to Martin

Army has awarded two contracts totaling $20.8 million to the Martin Co of Orlando, Fla, for research and production of the Pershing missile. One, for $12.8 million is for research and development work on the Pershing missile center. The other, for $8 million, is for industrial production of the missile. All of the work will be done at Orlando.

Members of the European Committee for the Cooperation of the Machine Tool Industries, and Belgian Minister of Commerce Maurice Brasseur (front row, center) leaving Brussels' Palais du Centenaire, site of the 7th European Machine Tool Exposition which was held Sept 3 through 12

Threadwell to Open New Cutting Tool Center

Construction on the first units of a new Cutting Tool Center in Greenfield, Mass, has been begun by Threadwell Tap & Die Co. First section will consist of a 65,000 sq-ft office and plant which will house tap, die, keyway broach and gage manufacturing operations. Threadwell's Conway Manufacturing Division will also be incorporated in the facility and plans call for expansion of the center to provide for the Cogsdill Twist Drill Division in addition to other products. Operations in the new center are scheduled to start in March.

McGIRK'S WORKS

POOR MONK IS STILL LAID UP IN THE HOSPITAL
YEH, BUT HE'LL CHECK IN SOMETIME TODAY
BUT HE'S SUPPOSED TO BE IN VERY SERIOUS CONDITION! WHAT MAKES YOU THINK THAT?
PAY ROLL
JUST A HUNCH!
MOE'S CORNER
Had to leave my last position on account of illness- the boss got sick of me

American Machinist / Metalworking Manufacturing

Announces the publication of an important and significant special report

"How to

PROVE THE PROFIT

in Numerical Control"

The principal editorial feature of the October 30, 1961 issue

NUMERICAL CONTROL COME

NUMERICAL CONTROL HAS COME OF AGE—Today, numerically controlled equipment is proving itself practical in many actual in-plant applications. Much has been written about numerical control since it was first introduced. Thousands of pages have been published to explain N/C techniques, developments, and new applications. The first article on N/C in a metalworking publication was an American Machinist Special Report in 1954, "Numerical Control, What It Means to Metalworking." American Machinist/Metalworking Manufacturing probably has published more on N/C than any other magazine.
Now there is a new need to be satisfied.

Numerical-control equipment represents a substantial capital investment. In spite of numerous satisfied users, and many obvious cost savings inherent in this control concept, many specific questions about its purchase and employment in manufacturing are puzzling potential purchasers:

1. How do we justify the initial cost?
2. How soon will N/C pay off?
3. Is labor cost the major saving?
4. Does N/C fit our production?
5. What types of equipment are available with N/C?
6. What machine tools and systems are in practical production?
7. How long can I avoid buying N/C equipment?
8. What are the characteristics of different N/C systems?

S OF AGE

American Machinist/Metalworking Manufacturing will devote the major portion of the editorial content of its *October 30, 1961 issue* to answering these and related questions. This report, the first such in-depth effort on the part of any publication, will give the readers sound economic justification for the purchase and employment of numerical control. And it will prove success by example. Such business journalism is possible only with the editorial and technical resources of AM/MM.

This factual, easy-to-use 32-page compilation will consist of two major sections:

1. How to select numerically controlled equipment, and
2. How to justify your investment in numerical control.

I. Selection of numerically controlled equipment will consider such topics as:

A. How to review existing manufacturing facilities.
B. How the product-line influences manufacturing requirements.
C. Special machines as a limiting factor in design change.
D. Can construction costs be avoided by eliminating equipment?
E. How much numerical control is needed for effective use?

An important part of this section will be a comprehensive fold-out presentation of technical characteristics and operational data, plus applications, for most of the numerically controlled machine tools and numerical-control systems currently available. This much comparative detail is not presently available in any form.

II. Economic justification of numerically controlled equipment will discuss:

A. The influence of numerical control on the *total plant economy*.
B. The problem of evaluating intangible benefits.
C. Analysis of each of the major areas of savings with N/C. Tooling, lead time, inventory, floor space, labor, scrap, etc.
D. How to develop useful cost data.
E. How numerical control differs from conventional manufacturing methods.
F. How equipment investment formulas can be helpful.
G. How to finance the purchase.

Outlining sources of funds, including the latest information on conditional sales methods and leasing programs. Discussing the proposition that possession, not ownership, produces the profit. To illustrate by example, this section will contain a substantial number of case histories of numerically controlled machines proving themselves in production.

At this time, when so many manufacturing men are beginning to recognize, and evaluate, this dynamic change in their business lives, this issue of AM/MM should have considerable impact.

STAINLESS
MOLYBDENUM
TITANIUM
BERYLLIUM
COBALT
COLUMBIUM
NICKEL
TANTALUM
TOOL STEEL
HIGH SPEED

TAP MAGIC
A CUTTING FLUID
FOR
• Improved Machinability
• Improved Surface Finish
• Improved Tool Life

THE STECO CORPORATION
BOX 2038 • LITTLE ROCK, ARKANSAS

FIELD REPORT

Pullman's Bessemer Plant Humming

Pullman-Standard's Bessemer, Ala, plant—where work came to a halt at the end of June because of lack of orders—is now operating with a payroll of 1300. Company recently received an order for 400 boxcars from the Gulf, Mobile & Ohio RR as well as a Louisville and Nashville order for 500 sets of hopper car parts. Cost of the L&N order is $950,000.

Ship Contracts Up on West Coast

San Francisco Naval Shipyard at Hunters' Point, which recent rumors had scheduled for shutdown, has been assigned to construct a $71 million guided missile frigate and to modernize two destroyers and a submarine. Four private shipyards in the San Francisco area have also received substantial contracts as part of the Navy's ship reactivation program. Largest contract went to Todd Shipyards Corp—a lump sum order of $2.2 million for work on two amphibious transports.

Deming Pump Now Crane Division

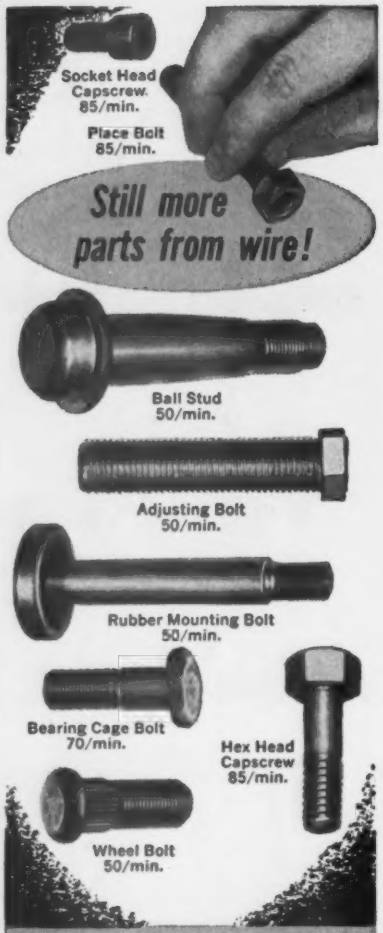
Crane Co, Chicago maker of valves and piping, has purchased substantially all of the assets of the Deming Co, Salem, Ohio. Deming, nationally known pump manufacturer, was founded over 100 years ago; sales of pumps and water systems have averaged more than $10 million for the past several years. Addition of its extensive manufacturing facilities will permit Crane to enter the industrial pump business for the first time in the US and Mexico.

Hayes Gets Aircraft Contract

A $4 million government contract for structural modification and maintenance of C118 aircraft has been awarded to Hayes Corp, Birmingham, Ala, aircraft firm. Company has received government orders in excess of $10 million since July of last year. Employment at the Birmingham facilities is approximately 3000.

Lance to Hold Machine Tool Show; Marks Tenth Anniversary

Lemuel R Lance Inc, Delaware Valley area machine tool distributor, will hold a special machine tool show for metalworking executives and operating personnel. Exhibit, to run from Oct 11 through 19, will be held

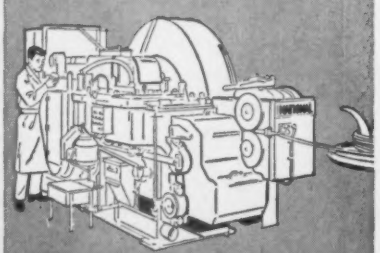


BOLTMAKERS make these interesting parts, and countless others, every day from wire.

Operations include cutting off, extruding, heading, trimming, pointing and thread-rolling.

It's just possible *your* metal parts can be made faster, stronger and at lower cost in Boltmakers (or in other types of Nationals).

May we help you investigate?



NATIONAL ½-INCH BOLTMAKER
4,200 PARTS PER HOUR!

NATIONAL MACHINERY CO.
TIFFIN, OHIO, U.S.A.
HARTFORD DETROIT CHICAGO

CIRCLE 363 READER SERVICE CARD
CIRCLE 364 READER SERVICE CARD

in the new showroom at 5th and Courtland Sts, Philadelphia.

Approximately 100 machines will be set up under power; many of them will feature tape and tracer controls.

Production Starts at New Plant Of Brush Beryllium

A multi-million-dollar plant which boosts beryllium metal fabricating capacity of the Brush Beryllium Co by 50% is now in production in Cleveland. Facility, when completed later this year, will represent a $3 million investment in plant and equipment and will replace three smaller fabricating locations which the company operated in the city.

New equipment for the plant will include about $200,000 worth of turret, engine, and tracer lathes. A 120-in. King double ram vertical boring mill recently purchased by the company is the plant's biggest piece of equipment. It has been used to mill the largest beryllium sintering ever produced, measuring about 75 in. in diameter by about 27 in. deep. New tracer lathe unit is able to reproduce forms in beryllium to a tolerance of 50 millionths.

Wheel Trueing Tool Co . . .

. . . Detroit-based manufacturer of industrial diamond tools, has acquired Drilling & Service Inc of Dallas. Truco diamond drill bits for the petroleum industry are manufactured in Dallas and, since 1946, the Texas firm has been Wheel Trueing's world-wide sales and service outlet. The new division will be known as Drilling & Service Inc, subsidiary of the Detroit company. •

AM/MM

"Why don't you face it, Al? Your logic is no match for the boss's screaming."

To solve your toughest stripping problem

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

Strip any type of paint fast...even epoxies ...with modern Oakite strippers

Even your toughest paint-removal problems can be solved with Oakite strippers. A dozen alkaline and solvent-type removers and additives are available to satisfy all needs. In the fastest, most economical way, they enable you to get a clean, smooth surface for repainting.

Oakite strippers are available to fit every method of application including soak tank...brush...steam gun. Look at these typical results:

- Stripping rejected television cabinets of paint and phosphate coating took 25 minutes before the proper Oakite material eliminated three steps, slashing time to 10 minutes.
- An auto parts maker says that a continuous cycle of 1 minute and 50 seconds "works like a charm stripping paint and incidental rust from rejects and hooks."
- Brass plated steel parts were stripped of their epoxy finish in a matter of minutes.

For stripper recommendation, just tell us your paint removal problem—the base metal, the paint type, number of paint layers, size of items to be stripped. Or ask your local Oakite man. Send for bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

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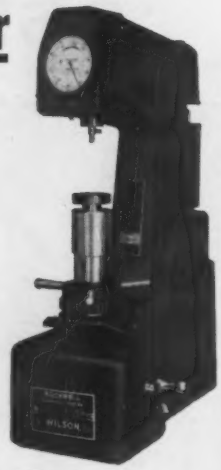
OAKITE
over 50 Est. 1909 SCIENCE
years' leadership in industrial cleaning

One of these Wilson "Rockwell" instruments will do your hardness testing job



No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

TwinTester—Combines functions of "Rockwell" and "Rockwell" Superficial testers.

Semi and Fully Automatic—for high-speed testing, at rates up to 1,000 pieces per hour. Automatically classifies pieces as CORRECT, TOO HARD, or TOO SOFT.

Special Machines—for testing large objects, internal readings, and other unusual applications.

Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.

Write for Bulletin RT-60

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

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Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
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CIRCLE 366 READER SERVICE CARD

production drill for precision holes

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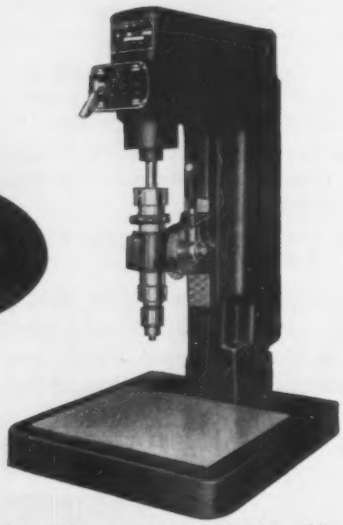

Let us show you how to knock hours off your production and precision drilling with this MA-8. Capacity to ¾". Eight spindle speeds with 10:1 range (variable speeds optional). Hand feed or air hydraulic. 12" swing. Column or bench type. One to six of our famous precision spindles, which give you quiet, vibrationless speeds up to 12,000 rpm. Send for Bulletin 857 or phone us. Avey, Box 1264, Cincinnati 1, Ohio.

NAMES IN THE NEWS

the newly formed Industrial Division which will handle all of the firm's industrial products manufacturing activities in the US.

Worthington Corp, Harrison, NJ, has appointed **Patrick L McManus** general manager of the Standard Pump Division. He was formerly director, marketing services

American Welding & Manufacturing Co, Warren, Ohio, has named **Frank J Shanaberg** to the newly created post of vice president, marketing. He was formerly sales manager of the Industrial Products Division.

OBITUARIES

Albert H Tinnerman, 82, board chairman of **Tinnerman Products Inc,** Cleveland, and the inventor of Tinnerman fasteners, died Sept 4.

Lawrence P Fisher, 72, Detroit automotive pioneer, and one of the seven brothers who founded the **Fisher Body Co,** died Sept 2. When Fisher Body was bought by General Motors he was made president of Cadillac Motor Car Co, a GM division. He later headed GM's Fisher Body division.

Robert E Gross, 64, board chairman and founder of **Lockheed Aircraft Corp,** Burbank, Calif, died Sept 3. He had served as chairman and principal executive officer of the firm for 29 years.

Alfred R Abelt, 71, former vice president of sales, and director of **Chain Belt Co,** Milwaukee, died Sept 11.

J Stewart Eagen, 68, board chairman of **Simpson Optical Manufacturing Co,** Chicago, died Aug 26. He had been president of the company since 1934 and chairman for the past four years. •

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 VERTICAL MILLING MACHINE—*Brown & Sharpe Mfg Co, Machine Tool Division, Providence 1, RI.* 20-page bulletin MM 57 contains specifications and illustrations covering the construction, operations, and accessory equipment for four new B&S Dynamaster No. 2 units. These machines are available with 3, 5, 7.5, or duel 10/5 hp spindle drive motors.

2 MECHANICAL PRESS BRAKES—*Verson Allsteel Press Co, 9300 S Kenwood Ave, Chicago 19, Ill.* 12-page catalog JI-61 presents design details and specifications for Verson Junior and Intermediate size models. Three series with capacities of 50, 65, and 90 tons are described. Bed and ram lengths range from 72 to 168 in.

3 DRILL POINTER—*Oliver Instrument Co, Adrian, Mich.* 12-page bulletin pictures and describes new Model 600. Provides technical information on the Oliver machines for wet and dry grinding as well as the new fully automatic drill pointer with automatic infeed. Included also is a description of the Oliver drill point which provides reduced torque and thrust. Last few pages of the brochure cover Model 21 bench drill pointer and the drill point thinner.

4 HYDRAULIC TRACER CONVERSION UNIT—*Detroit Broach & Machine Co, Rochester, Mich.* 2-page technical data sheet DHT-161 tells how a standard lathe can be converted quickly into a hydraulic tracer controlled machine. Describes features of a newly developed hydraulic tracer conversion unit; covers conversion and operational advantages; includes illustrations and diagrams of typical machining applications and part configurations which may be handled as well as optional features for added versatility in production line operations.

5 GAP PRESSES—*Minster Machine Co, Minster, Ohio.* 4-page bulletin 21 covers Series 70 fixed base open back gap presses in 45 to 60-ton capacities. Contains specifications and dimensions; illustrates design and construction features which include cast iron frame, sliding die cushions, air friction clutch and brake, slide, variable speeds, feeds, and lubrication arrangements.

AM/MM

"I take it you've had a new offer!"

Nobody, but nobody, tends your die set needs with such dispatch as Danly. Whether you want a new Precision Pilot Guide Post for extra ease in die set assembly . . . or a fast order placed for a special die set, you can depend on your nearby Danly man for quick, effective action. Like all 23 Danly branches and distributor assembly plants, he stocks a wide selection of die sets and diemakers' supplies for immediate delivery. Next time you need die set service, call your Danly man. He's as close as your phone—and at your service 'round the clock.

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NEW INSULATED Demountable Bushings, designed for use in machining mounted dies by electrical discharge, are fully described in new, fact-filled bulletin. Write for your copy.

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Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

6 PRESS OVERLOAD DETECTOR—*Di-Matic Controls Inc, 100 Beadel St, Brooklyn 22, NY.* Bulletin MID-2 pictures and describes new fully adjustable detector designed for use with any basic model Di-Matic press control of the 100 or 200 series. Shows how the detector works in conjunction with the Di-Matic Control system which also supplies protection for dies in the event of misfeed, stock buckling, material pile up, or coil coming to an end. Sensor unit installation and cam-switch arrangement are also described, and the cost of a typical installation is given.

7 LEADSCREW UNIT — *Foote-Burt Co, 13000 St Clair Ave, Cleveland 8, Ohio.* 2-page engineering data sheet describes new positive-feed electromechanical leadscrew unit for drilling, boring, reaming, counterboring, spotfacing, chamfering, or milling. Claimed to be the only mechanical-drive unit available which can feed against a positive stop and provide tool dwell, a frictionless ball-recirculating nut is employed for the precision leadscrew feed mechanism, providing high production rates. Construction and operational features of this self-contained unit are given, together with feed-rate tables.

TOOLS AND ACCESSORIES

8 CUTTING TOOL LITERATURE—*Brown & Sharpe Mfg Co, Providence 1, RI.* 4-page guide, Form C-48, is available to help users of B&S cutting tools. Thirty brochures, booklets, catalogs, and article reprints are described in the folder and a reply card is enclosed to simplify ordering one or more copies of the literature desired.

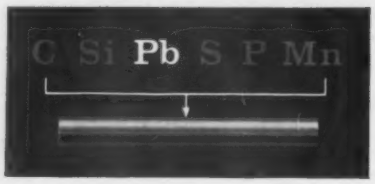
9 DYNAMIC AND STATIC BALANCERS—*Gisholt Machine Co, Madison 10, Wis.* 20-page catalog, Form 1165-C, covers Type S dynamic (two-plane) and static (single-plane) units. Type S machines are designed for balancing parts weighing from 1 to 300 lb to accuracies of 0.000025 in. of displacement at the supporting bearings. Includes the revised specifications on the eight standard Type S machines and an explanation of standard features. Special accessories and typical jobs are covered.

10 MILLING CUTTERS — *Vascoloy-Ramet Corp, Waukegan, Ill.* Two catalogs give details on V-R's expanded line. Detail drawings and charts provide data on each cutter series including sizes available, complete product specifications, and ordering information. Catalog 6103 describes V-R throw-away insert face mill cutters for rough, semi-rough, and finish milling. Catalog 6104 covers Rigidcut and Varicut inserted blade milling cutters. Rigidcut series is designed for general purpose or high production milling operations and consists of two basic styles, fine pitch for high-speed, fast-feed milling, and coarse pitch for light or medium feed and speed combinations. The Varicut series provides 4-way interchangeability for plain, full side, half side, and staggered tooth milling.

11 EXPANSION FIT METHOD OF ASSEMBLY—*Cincinnati Sub-Zero Products, 3930 Reading Rd, Cincinnati 29, Ohio.* Illustrated 12-page bulletin discusses expansion fitting as a time-saving, reliable assembly procedure. Contains a full case history together with photos illustrating expansion fitting bearing raceways; includes tables of expansion coefficients and nomograms for calculating rates of thermal expansion and determining the temperatures required.

Tomorrow's tubing technology—today

Tubing with built-in lubrication speeds machining operations



Where machinability is of major importance, use Superior Seamless Leaded C-1020 Carbon Steel Tubing. It permits higher speeds and heavier feeds, often reduces the number of finishing operations required to produce a smooth, lustrous surface. Build-up of metal at the cutting edge of the tool is minimized. Chip formation is improved. Tools operate at lower temperatures, last longer, require fewer dressings. It is interchangeable with nonleaded carbon steel tubing because there is virtually no difference in physical and mechanical properties.

Superior Leaded C-1020 Tubing is available in ODs from .012 to 1⅛ in. Complete details are contained in Data Memorandum No. 24. Write for your copy today. And remember that we offer small-diameter tubing for many other purposes in over 120 analyses, in quantities from 50 to over 1,000,000 ft. Superior Tube Company, 2505 Germantown Ave., Norristown, Pa.

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NORRISTOWN, PA.

West Coast: Pacific Tube Company, Los Angeles, California

12 PROFILOMETERS — *Micrometrical Manufacturing Co, 3621 South State Rd, Ann Arbor, Mich.* 12-page general catalog covers complete standard lines of Profilometer instrumentation for measurement and control of surface roughness. Many special products are also illustrated and described.

HEAT TREATING AND WELDING

13 AC ARC WELDERS—*Birdsell Products, 350 N Halstead, Pasadena, Calif.* Bulletin 190-1 describes portable, lowcost ac arc welders with range from 10 to 190 amp for use on 110/220-v lines. Welders are built to REA and NEMA specifications and are approved by Underwriter's Laboratories. In addition to listing 10 important features, the bulletin also instructs user on how to install, strike an arc, weld, and the control of heat and amperage.

14 SHIELDING GASES—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 6-page publication, form ADR 135, "How to Choose the Right Shielding Gas," is a basic guide for the selection of the most efficient product for welding any metal with either consumable (MIG) or non-consumable (TIG) electrode processes. The gases—argon, helium, carbon dioxide, and combinations of argon-helium, argon-oxygen, argon-hydrogen, and nitrogen-hydrogen—are discussed in detail. Applications and advantages of each process are given. Booklet is illustrated with charts and photos.

PLANT SERVICE EQUIPMENT

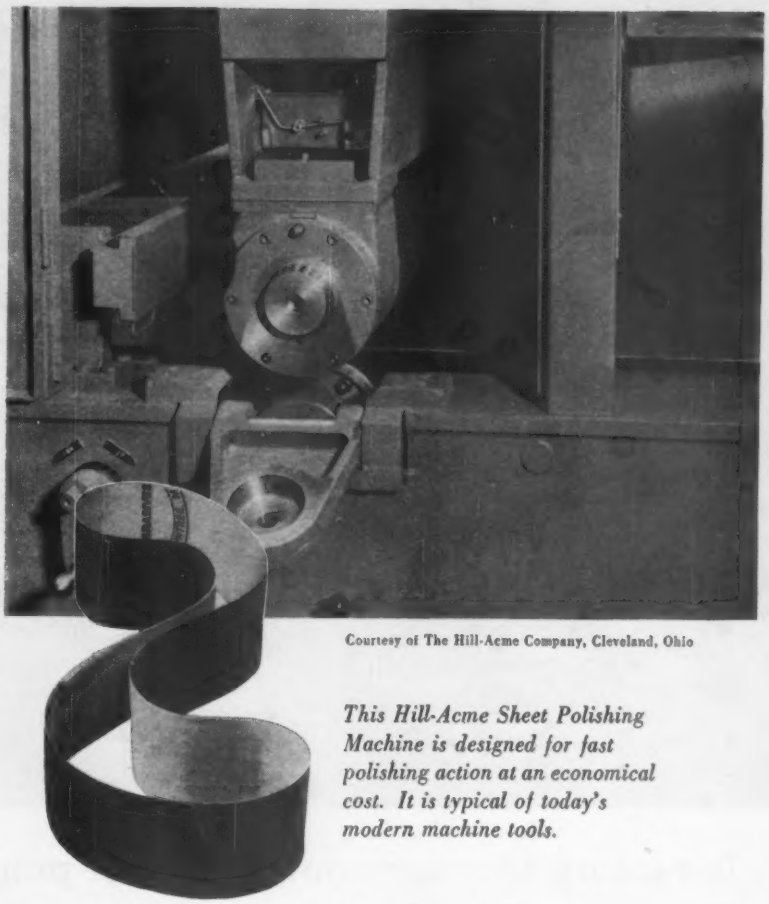
15 CENTRIFUGAL PUMPS—*New York Air Brake Co, Aurora Pump Division, Loucks at Dearborn, Aurora, Ill.* 8-page bulletin 105C illustrates and describes complete line of single-stage, double suction, horizontal split case pumps. Capacities range up to 6000 gpm, heads to 380 ft. Contains sectional photos, selection charts, dimensional data, limitations chart, and engineering specifications.

16 FANS—*American Standard Industrial Division, Detroit 32, Mich.* 48-page illustrated catalog A-1401 covers line of Sirocco fans, Series 81, Class I and II. Drive arrangements, control methods, and types of drive are described and pictured. Capacity tables are provided for the full line of 15 sizes of single-inlet single-width design, and 12 sizes of double-inlet double-

AM/MM

"That supposed to improve my corporate image?"

Idle machines cost money. Rely on Jewel Brand abrasive belts to keep yours running



Courtesy of The Hill-Acme Company, Cleveland, Ohio

This Hill-Acme Sheet Polishing Machine is designed for fast polishing action at an economical cost. It is typical of today's modern machine tools.

Machine tools effectively cut costs, increase efficiency and speed of production lines. But, the wrong abrasive belt can cause shutdowns and delays. Belt breakage, marred finishes and similar mishaps create costly production bottlenecks.

That's why experienced operators have come to rely on Jewel Brand abrasive belts. Jewel Brand belts are made in a variety of grains, bonds and backings to meet virtually every requirement. Jewel Brand's "Velvet Joints" permit an even flow of cutting surface, eliminating chattering and jumping.

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Inventory Management Simulator program at...

Clark Equipment... improves customer

■ **High-capacity memory.** Two IBM 305 Data Processing Systems with RAMAC keep track of 75,000 replacement and repair parts in Clark's Chicago parts warehouse. ■ **The computer has the facts.** As soon as shipments arrive at the warehouse, an operator, using this remote inquiry station near the loading platform, finds out from the computers where various items go. ■ **Customer service first.** Using this remote inquiry station in the sales department, the operator gets information from the computer while the customer is on the phone.

Clark Equipment Company has prepared a computer program called an Inventory Management Simulator. The program allows Clark management to study the possible effects of decisions on future customer service and future warehouse profitability. When management gets the computer's report, it is in a position to make new rules for the operation of its parts warehouse.

Here's what's happened since Clark put the new program into operation:... improved customer service... practically eliminated back-order problem . . . reduced the putaway time for incoming material by more than 50 per cent . . . reduced emergency order shipping time by 50 per cent... enabled a physical inventory to be taken without any interruption of service to customers.

CIRCLE 373 READER SERVICE CARD

service...with less inventory

Availability highest ever. Inventory management is a complex job at Clark. Its Chicago warehouse is one of the busiest and largest in the country. Before the Simulator program was developed, the warehouse carried an inventory of 85,000 individual replacement and repair parts. Use of the program helped transfer the investment in inventory to those parts most frequently called for, giving high availability with less investment.

Management Operating System.* Clark installed two IBM 305 Data Processing Systems with RAMAC.® These computers store, update, and offer on an instant's notice information on almost every aspect of the warehouse operation including complete information on every one of the 75,000 items maintained in stock.

Now, Clark is assured of maintaining just the right level of stock for each item. The procurement formulas, developed from the Inventory Management Simulator, even recommend how large a purchase order should be placed for each item and where it should be placed.

If you have an inventory problem, why not consider a simulation program? You don't have to have your own computer. We can supply you with an Inventory Management Simulator...you can rent time on a computer. Result...improve the profitability of your warehouse operation.

**A Management Operating System uses IBM computers to make routine business decisions and take action automatically ...flags problems that need management's special attention... frees management to concentrate on the big problems and on long range planning. As a result, it gives tighter control of all business operations...and helps cut costs.*

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DATA PROCESSING

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MEEHANITE MEANS BETTER CASTINGS®

Standard construction materials for all Blackmer Vari-Flo pumps is high strength, pressure-tight Meehanite Nodular Iron. It provides the necessary mechanical properties and is less costly than steel, particularly from the standpoint of machining. The intricate rotor shown, a critical internal part subject to high stresses, is cast in type SP-80 to insure top performance under the most severe service conditions.

SOLVE YOUR TOUGH CASTING PROBLEMS WITH MEEHANITE NODULAR

The excellent castability of Meehanite Nodular in combination with exceptional strength, ductility and wear resistance has led to its wide acceptance for intricate pressure castings and many other components which must withstand severe service conditions. The broad range of its utility is further enhanced by inherent production advantages resulting in a reduction of manufacturing costs.

Meehanite Nodular is available in a broad range of properties embracing all current Nodular specifications and including some unique new wear and heat resisting types. When you specify one of the S types of Meehanite Nodular, you can be sure of obtaining castings that live up to specified claims. Meehanite foundries have more than a quarter of a century of experience in handling the essential materials used to convert the graphite in cast iron from the flake form to the nodular which gives this family of metals its unique engineering properties. Meehanite patented quality controls assure uniform dependability regardless of how small or how large the casting.

For complete information about Meehanite Nodular, send for a free single copy of our eight page brochure (B-47-A). Write: Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

MEEHANITE METAL

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

width design. Outline drawings are keyed to tabular data to provide important dimensions for use in workng layouts.

17 CLOSE-COUPLED PUMPS — *Allis Chalmers Manufacturing Co., Milwaukee 1, Wis.* 2-page data sheet 52B1010 provides information on fractional horsepower, single stage single suction Model C-15-Type RHK designed for lowcost handling of clear non-corrosive liquids at temperatures up to 180 F. Available in a range through 48 gpm with heads to 100 ft, the unit can be installed horizontally or vertically. Casings have centerline discharge, are self-venting, and can be rotated to any of four 90° positions.

18 SOLUBLE OIL MIXER—*Force-Flo Inc, PO Box 2442, East Cleveland 12, Ohio.* 2-page illustrated bulletin explains how the mixer inserts into a drum to mix soluble oil and water accurately and uniformly in the exact proportion required. Points out savings in time, material, labor, and space effected by the mixer that dispenses emulsion directly from the drum in 1/10 of the time normally required.

PARTS AND MATERIALS

19 "ALCOA ALUMINUM SCREW MACHINE STOCK"—*Aluminum Co of America, 728 Alcoa Bldg, Pittsburgh 19, Pa.* 154-page spiral-bound handbook's four tabbed sections cover general information, properties and tolerances, estimating information, and tooling and operating data. Initial section summarizes mechanical and physical properties and machining characteristics, and lists sizes, tempers, and applications for each of the five standard aluminum screw machine stock alloys. Balance of the book includes such data as machinability ratings, recommended thermal treatments, tolerances, recommended feeds and speeds, and amount of stock and number of hours required to make 1000 pieces. Also included are complete weight tables, screw thread data, recommended cutting fluids and lubricants, tool description, and finishes.

20 VARIABLE-SPEED BELTS—*T B Wood's Sons Co, Chambersburg, Pa.* 14-page bulletin 24103 in addition to general information, contains five tables among which are: Alphabetical Listing of Applications which lists all known manufacturers of equipment using variable-speed belts. The manufacturer's variable-speed belt part number is given with Wood's comparable number. Numerical Listing lists belts according to size using the new standardized numbering system which conveys width of sheave groove in sixteenths, groove angle in degrees, and belt pitch length in inches and tenths.

21 TOOL STEEL—*Dodge Steel Co, 6501 State Rd, Philadelphia 35, Pa.* 2-page technical data sheet describes a new grade, Dodge Grade DTS-30W8, a low carbon, medium tungsten hot work steel with excellent red hardness. It is used for tools which operate at a dull red heat. Information included on hardening, annealing, tempering, hardness, as well as suggested applications for the metal.

22 MINIATURE GEARS—*Perfect Gear & Instrument Corp, 339 S Isis, Inglewood, Calif.* 256-page catalog 6A covers complete line of stock miniature gears in Precision I, II, and III. Many new items are included in this edition including gears with bores from 0.0900 to 0.3750 in. and face widths from 1/16 to 3/16 in. Complete line of anti-backlash gears and mechanical slip-clutches has also been added. Contains specifications for stock precision clamps, bearings, shafts, retaining rings, roll pins, related electro-mechanical specialties. ●

#1 — 0 — 00 — 000 center drills are now available as "standards" from Woodruff & Stokes . . . and with "Special Tool" features.

- **Super Alloy HSS**
- **Right or left hand cutting**
- **Ground all over for extremely fine dimensional control**

SPECIFICATIONS

SIZE	BODY DIA.	DRILL* DIA.	DRILL LENGTH	O.A.L.
1	1/8"	3/64"	5/64"	1¼"
0	1/8"	1/32"	1/16"	1¼"
00	5/64"	.025"	3/64"	7/8"
000	1/16"	.015"	.030"	7/8"

60° included angle standard.
*Specials as small as .005" are available.

Write today and get the full story on W & S Miniature Center Drills and other small precision cutting tools.

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This special report summarizes typical mechanical fastening devices and will help you select a fastener that wil lead to a more dependable and economical product. Sixteen pages, fuly illustrated—35c per copy.

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Over 40,000 in use. Accurate, non-marring hardness testing on small or massive objects such as rolls, lathe beds etc. Model C-2 (above) or Model D with equivalent Brinell or Rockwell C numbers. Repair and calibration facilities at your disposal.

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Both NEW *and* DIFFERENT SHELDON 15" PRECISION LATHES

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New. Revolutionary double-box Headstock (Pat. Pend.)
New. "WORK-HOLDING ONLY" Spindle.
New. Single-Shift Back Gear Lever on Headstock.
New. Headstock and Apron running in oil.
New. 1⅛" Hole through Spindle.
New. 60-pitch Gear Box with built-in Lead Screw Reverse.
New. Amazing LOW PRICE.

DIFFERENT

Different. Spindle rigidly held in two large "Zero Precision tapered roller bearings arranged in box-type design.
Different. Electrical switches and push-button stations fully enclosed in built-in well in headstock.
Different. Two independent clutches in apron for selecting power feeds.
Different. Cam-action tailstock clamp for rapid release and instant locking of tailstock.
Different. Triple, cogged, V-belt outboard drive—eliminates intermediate shafts—delivers more power to spindle.

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- ☐ 11" and 13" Variable Speed Lathes
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- ☐ Sebastian 13" and 15" Geared Head Lathes
- ☐ Horizon Milling Machine ☐ Sheldon 12" Shaper
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Name_____ TITLE_____
COMPANY NAME_____
STREET ADDRESS_____ ☐ COMPANY ☐ HOME
CITY_____ STATE_____

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POSITION WANTED

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The Searchlight Section is at your service for bringing business needs or "opportunities" to the attention of men associated in executive, management, sales and responsible technical, engineering and operating capacities with the industry served by McGraw-Hill publications.

SEARCHLIGHT SECTION

ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

3. Automatics
7. Boring Mills
8. Broaching Machines
11. Chucking Machines
17. Drilling & Reaming Machines
25. Gear Cutting Machines
26. Grinding Machines
28. Honing & Lapping Machines
31. Lathes
37. Milling Machines
42. Planers
45. Press Brakes
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53. Saws
56. Shapers
57. Shears
58. Sheet Metal Machinery
66. Welding Equipment
69. Books

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"No Cost or Obligation"

This service is aimed at helping you the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

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c/o American Machinist/Metalworking Manufacturing
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TITLE ..... COMPANY .....

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10/2/61

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OFFERS "GUARANTEED" MACHINE TOOLS—

RBG = Rebuilt Condition Guaranteed
RCG = Reconditioned — Guaranteed
*Indicates 1940+ Model **Indicates 1950+

AUTOMATICS
*9/16"—6 spdl Acme RAG w/Thrdg & Tooling
*1½"—6 spdl Acme RAG w/Thrdg & Tooling
*1½" Cleveland 1 Spdl Model B-18

BOREMATICS
**221 & 321 Heald Sgl. End. 2 Spdl Excellent
**1212A Excello Dbl End. 4 Spdl 1943 RCG
**2U Simplex Dbl End Dbl Spdl Excel
**3U Stokerunit Dbl. End Dbl. Spdl. #DH-4 Heads
**421 Heald, Sgl End, Hydr 32" Swing 1950's

BORING MILLS
36" King VBM complete
*36" Bullard VTL. Side Head
*52. King VTL Side Head Clean
**54" G&L "Hypro", w/extra Height Excel.
*74" Bullard "Cutmaster" VTL Excel. Like Rblt.
*4 Sellers Horiz. Tbl. Type (1942)
*3" Universal Horiz. Tbl. Type (1941)
*3"—5H Sellers Floor Type—Nice Cond.

BROACH
**6 ton—54" Colonial Hydr Sar 13094, Excel.
**15 Ton 90" Lapointe vert. Hydr. Mod SRV S/N 52252

CHUCKERS
**HC Hardinge Chuckers. 1950 & later
*6"—8 Spdl Acme RPA-8 S/N86971

DRILLS
*1R Bakewell Radial Arm Drill 1 HP
*21" Canady Otto #4 MT 19" Dia. Table
**22" Allan Box Col. 1 HP 6" Spdl. Feed
*25" No. 262 Barnes 4 MT, Air feed 3 HP
*28" Avey 2BMA6 w/Doen Hole Attch.
*28" Colubrn No. 4 MT. 3" cap. 10 HP

DRILLS, MULTIPLE SPDL.
*3 Spdl. Lee-Giff 3 Spdl. Base 3600 RPM 2 HP
*4 Spdl. Lee-Giff #2 MT 3600 RPM 1 HP
**6 Spdl. Allan #2KH-24", ½ HP Mtrs.
**24 Spdl. H-6 Natco Hydr Table ¾" U.J. (1950's)
**36 Spdl. C5B Natco 2½" U.J. 28 x 54 Head
**24 Spdl. C3B Natco 1½" U.J. 20 x 30 Head

DRILLS, RADIAL
*3' x 9" Cinc Blck w/Box Table
*3' x 11" Carleton Univ Box Table
*4' x 11" Carleton, Tp'g P. Elev., Tbl.
*4' x 11" Amer. "Hole Wizard" RBG
*5'-15" Cinc Bickf. Power Elev. Clamp, Traverse

GEAR MACHINERY
**#58-2 Vinco Gear Checker Involute
*#18 Gleason Hypoid Cutter Sharpener
*#860B Mich. Gear Finisher, Microflex Counter
**#106 Gleason Gear Generator s/n 32036
*#12 Gleason Generator Dbl. Roll R & Finisher
*15" Gleason Spir. Bev. Cutter Grinder

*#00 & #1 Hamilton Hobbers
*Type A Barber Coleman Hobbers (1 long bed)
**05AB Fellows Shaper w/access
*Type 6 Fellows #61 Shaper 35" OD Cap 1950

GRINDERS, MISC.
**Wendt Sonis Econogrind #1A195
**Blake Fine Grinder to ¾" Cap
*4 x 12 Landis Ext. w/Plunge (2)
*6 x 18 Landis Ext. w/Plunge #24473
12 x 36 Cinc. Univ. w/Int. Spdl. RBG
*16 x 36 Landis Cyl. w/5" Head
*18 x 18 Landis Cyl. Hydraulic
**Wickman Microform (optical) Like New
**180 Sheffield, Multiform (1957) Like New
**10x24 Cinc Univ. Plunge & Int Spdl (1953)
**10x24 No. 4BGI Van Norman 15" Head '55
**12x36 Landis Univ. Int Spdl (1950')
**30x48 Landis CHW Univ Like New 1952
*#2 Cinc. Centerless, Profile Dresser RBG

GRINDERS, INT.
**1100 Bryant Internal 6" Str. 9. swing Excel
**1516R Bryant Hole Face & Int. 28 Spdl (1952)
**271 Heald "Sizematic" Internal RBG
*100 Bryant Int. New Spdl. (1947) RBG
*72A3 Heald TR Mod. & Sizematic Med.
*16-16 Bryant Chucking 1600 RPM
**#172 Heald 36" Swg. 36" Str. '43 & '50

GRINDERS, SURFACE
*12 x 36 Mattison, Hydr. Dresser
*12 x 36 G & L Hydr. Crush Grind Attch. 15 HP
*36" Hanchett #36 Rotary. 30 HP
*18"—#11 Blanchard Vert Rotary RBG
**#240—30" Besley Dbl. Opposed w/Ferris wheel

INSPECTION EQUIP.
K&E Trammel Insp Equip—½ Price—Like New

LAPPERS
*74A Excello Centerlap. 10 x 36, ½ HP
*28F Norton Hydr., Vert., 20" Cap. 10 HP

LATHES
*12 x 96" Monarch T. R. Mod w/access.
**15 x 54 LeBlond Dual Drive w/acces.
*18 x 110 L & S w/TA. Chucks etc.
*20 x 120 Springfield Tool'g. 10 HP RCG
*24 x 96 LeBlond H.D., T. Att. Chuckh (1942)
*22 x 120 L & S w/Chuck, SR etc.
*30 x 84 American 18" Air Chuck Coolnt.
*40 x 68" LeBlond H.D. Dual Contr. 40 HP
*42 x 35 ft. Wickes H.D., 2 Carriages
*30" x 48" Monarch Mod CM, Sar. #16326
*30 x 96 Niles "Timesaver" T.A. 3J, 4J RBG
*74 Star "T" Lathe, 15 HP Like New

LATHES, TURRET
**10 x 20 Monarch EE Mfg. Type 4000 RPM
**2 B & O w/Barfeed, Collets etc.
*#4 Gisholt Univ. H Ways 2½" Cap
**#3 Gisholt, Barfeed, 1952, Excel.

*#3 W&S w/Hydr. Barfeed & Tool'g RCG
*#4 W&S Preselector, Air Chucker (1942)
**#5 Gisholt Univ w/Chucking (1950's) RCG
*8B J&L Saddle Type 3" Bar Cap.
*1A W&S Saddle Type 800 RPM
**2A W&S with Access. 1952 & 1948
**3L Gisholt & Preset w/CS Turret 1952
*2A W & S Saddle Type 3½" Cap B, Feed

LATHES, PRODUCTION
**Gisholt Simplematic Autom 20", Reatten Table.
**17 x 76 Seneca Falls "Le Swing" 50 HP.

LATHES, TRACER
*30H Bullard 3 Spdl. Man-Au-Trol #28104
**60" Monarch "T" w/generator (1952)
**45"x96" LeBlond Hydro Trace (1959)
*36"x36" Monarch H.D' w/Keller Tracer

MILLS
*3K K&T Horiz. Ser. RBG
*4K—K&T Horiz., 18x42 Tbl. Trvl. 15 HP
**5HM—K&T Horiz. 18x94" Tbl 20 HP
**#4 Cinc H.S. D.T. Vert Mill (1951)
**2-24 Cinc Autom #50 MT Autom Quill Retr.
**38—2448 Sundstrand Rigidmill 15 HP '52
*56x96 Cinc. Hydrom., Simplex RCG
*36x36x146" Ingersoll Planer, 4 Heads
**Beam Mill, Onsrud—Tracer Controls 24'x9' table ('58)

MILLS — TRACER
*28-60 Cinc Vert Hydrotel 360° RCG
*28-96 Cinc Vert Hydrotel Hand & Depth Controls
**36-96 Cinc Vert Hydrotel 3D Controls
*36-72 Cinc Horiz Hydrotel Dual Controls

MULT-AU-MATICS
**12"—12 Spdl Bullard Type K @29340
*16"—8 Spdl. Bullard Type D RCG

PRESS
**45 Ton Clearing OBI 4" Str 18x30 Bed
*65 Ton #74 Bliss gap frame 13x26 Bed
**75 Ton 9F Cleveland SS Trim'g Attch 5" Str.
**75 Ton Watson Stillman Hydr 20" Str.
**80 Ton #7 Federal OBI 8 x 12" Str.
**106 Ton A5 Niagara OBI 8" Str. Cushion
**400 Ton Ferracute E401, Knuckye Joint
400 Ton Cleveland Toggle Model 90T96 RBG

ROLLS
12" x 1" NBP Pyramid, Drop End, Older, Good

SAWS
*16" ML16 Doall Vert Band w/welder
**20" DoAll "Contourmatic" V. Band Hydr.
**36 DoAll H.S. Vert. Band., Hydr. Tbls (1953)

WELDERS
**50 KVA Taylor Winfield Press Type Univ. Spot
**75 KVA Sciacy Spot 3 phase w/controls
**75 KVA National Circular 18" Thr 440 V
**100 KVA Thompson No. L83, Longitudinal
**Welding Positioners 10 to choose from

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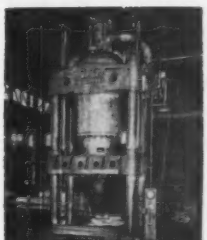


1000 TON WATSON STILLMAN

Down moving, 4 column with pullback cylinders and safety head
Bed area: LR 63, FB 60
60" Daylight, 48" Stroke
32" ram diameter, 9" columns,
21" x 63" between columns.
60" x 60" top platen, self-contained, 75 Hp 2500 Psi, 6' x 8' floor area
Overall dimensions: 6' x 9' x 18'

200 TON H.P.M. FASTRAVERSE

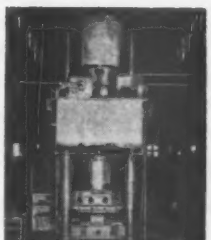
High Speed, Down moving, straight side (tie rod)
Bed area: LR 31", FB 31"
6" max. Daylight, 37" Side Clearance
60" max. ram, 14" ram diameter, 2600 PSI operating pressure.
4' x 6' LR floor area, 22' high

100 TON PRENTISS

Oil Gear, Down Moving, Double Acting
Bed area: LR 36", FB 36"
24" Stroke, straight side (with tie rod)
11" ram diameter, 54" high main ram, 36" pullback
23" max. work height, 40" bed to crosshead, self-contained.
With prefill tank, pump—oil gear—adj. volume, flat belt drive by G.E. 3/60/440 motor.
8' x 4' floor area, 13' high

EASTERN MALLEABLE

New Castle Ave. & F Street
Wilmington, Delaware
PHONE
Mr. Robert Carlan OLympic 5-0554



750 TON BALDWIN SOUTHWARK

Down moving, 4 column with pullbacks
Bed area: LR 53", FB 42"
48" Daylight, 40" Stroke
25" ram diameter, 9" post diameter, 53" x 31" between columns.
Self-contained motor and pump, 52" x 42" ram area w/4 "T" slots 1"
9' x 9' floor area, 19' high

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1½B Pratt & Whitney Jig Borer, 1943, w/Rotary Table Tooling. Excellent Condition.
2-24 Cincinnati Prod. Mill R&F 1944.
No. 172 Barnes Vert. Hyd Hone Dia. 2" Str. 7" Auto Str. Cycle, '43.

Machinery Since 1919
EDWARD FRANKLIN SCHILL
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Mitchell 2-1491

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#7 Kling Univ. Ironworker 6"x6"x½" cap. New 1954
#3 and #4 Kling Friction Saws
3K K&T Vert. Mill
¾" Kane & Roach Shape Straightener
27"x22' e Niles Lathe, Late
14"x36" Mattison Hyd. Surface Grinder
20"x120" Monarch Model CM

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COOK COUNTY MACHINERY COMPANY
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EASTERN

Rebuilt Machine Tools

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THE MARK OF DEPENDABILITY

28" Rockford Universal Shaper, hydraulic, late.

50"x41' centers and 60' centers LeBlond Heavy Duty Lathes, internal geared, two carriages, tapers, steady rests, late.

36"x20' Centers Betts Bridgeford—Consolidated—Engine Lathe, 1943, machine, extra heavy duty.

6'17" American Hole Wizard Radial Drill, extra clean.

100"x72"x30' table Cincinnati Hypro Planer, openside with four heads, variable voltage.

60"x60"x30' table Sellers, Planer, angle drive, variable voltage, late, four heads.

22"x88" Landis Crankshaft Grinder, latest.

42"x72" Norton Plain Grinder, latest model, reasonable.

20" Rockford Slotter, latest model, extra clean, two mach.

36" wide, 72" table Thompson Surface Grinder, 1947.

20"x168" centers Lodge and Shipley Lathe, 1944.

36"x36"x14' Rockford Hydraulic Planer, four heads, variable voltage, extra clean.

60"x75"x20' Cincinnati Hypro Planer Miller, three heads, 25/50 HP capacity each head, 1949.

24"x72" Landis Type F Plain Cyl. Grinder, latest model, extra heavy, new 1953.

THE EASTERN MACHINERY CO.
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241 CABLE ADDRESS **EMCO**

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IMMEDIATE DELIVERY

2—#5 MINSTER HIGH SPEED O.B.I. BLANKING PRESSES, 45 ton, Flywheel type, 11" stroke, 5 HP Varidrives, Speed range 150-300 SPM. Equipped with #4-6 Perfecto Double Roll Feed and Scrap Cutter. Never used.
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PRICE F.O.B. East Boston.....$9500.00 each

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PR 5-4311

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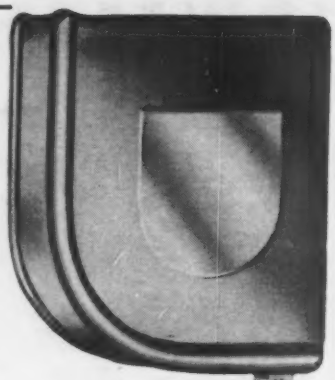

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SEARCHLIGHT SECTION

American Machinist | **Metalworking Manufacturing**

CLASSIFIED ADVERTISING DIVISION
POST OFFICE BOX 12
NEW YORK 36, N. Y.

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- Use this time - saving service to keep abreast of the latest in used, rebuilt, surplus new equipment, employment or business opportunities.

INDEX TO ADVERTISERS

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Precision is the reason!

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OBERG CARBIDE DIES are made to exacting standards and feature guaranteed interchangeable components. This simply means that each and every Carbide Cut-Edge in an OBERG CARBIDE DIE or its replacement is made to fit perfectly. No need to special fit die parts if a part should break. Since detailed information is filed on every OBERG DIE in active service, a phone call generally starts the replacement detail on its way. Such interchangeability assures easier and less costly maintenance . . . standard results with all OBERG CARBIDE DIES, because. . . .

Oberg is something special

Oberg Manufacturing Co., INC.
FREEPORT, PA.

Send today for Bulletin 261. It describes Oberg Carbide Dies, plant facilities and services.

CIRCLE 381 READER SERVICE CARD

WHAT ANGLES ARE BEST FOR OXIDE CUTTING TOOLS?

Recent experience shows that the geometry of carbide tools is not suitable for ceramic tools. Here's a 14-page reprint from AM/MM spelling out key points in tool geometry for oxide cutting tools. It's available for 35¢ from

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Stahl

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making Dies and Templates

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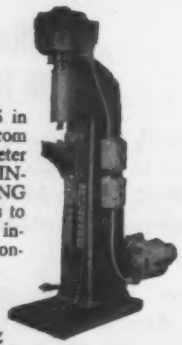

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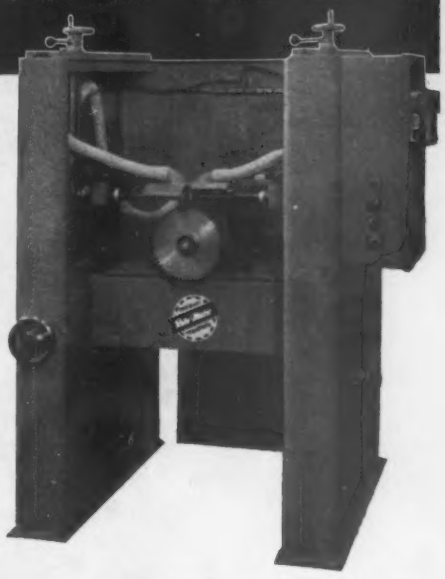

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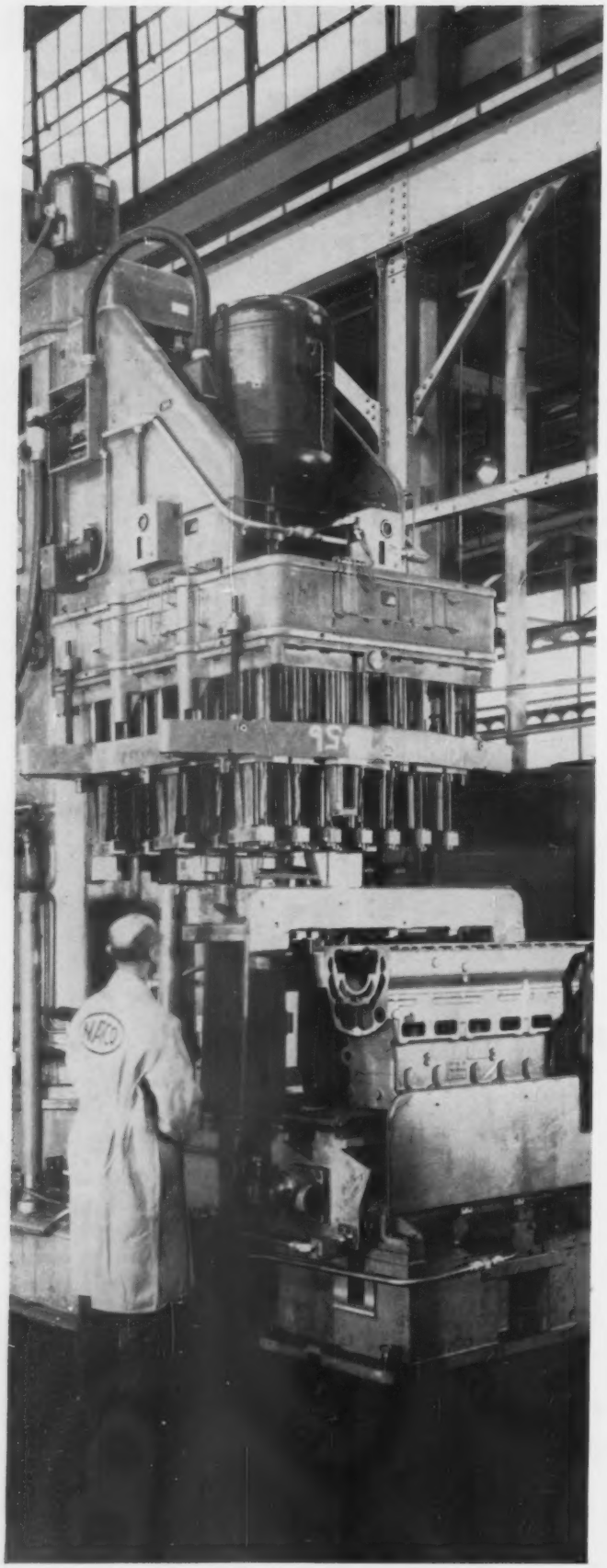
LOADING: Metal particles packed in between or completely covering the abrasive grains of the belt coating.

GLAZING: Face of belt smooth and glossy—indicates dulling of abrasive grain tips.

STRIPPING: Particles of the grain and bond pulled away exposing bare backing.



How NATCO'S 87 spindles stay accurate

When National Automatic Tool Company designed this Model C5A-129 machine that drills, reams and counterbores, they had some tough problems. One was long-lasting accuracy for the 87 spindles requiring 174 bearings. The bearings used would have to assure accuracy under heavy loads at high speeds. And space limitations demanded that the bearings have maximum radial and thrust capacity in minimum space.

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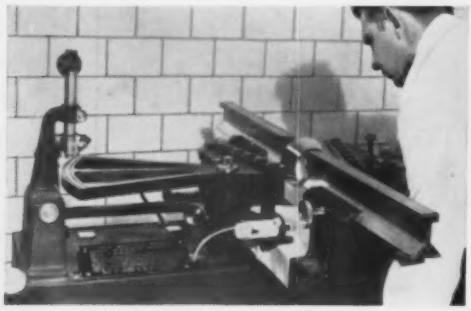

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